

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Number and Quantity: The Real Number System (N-RN)</b> <b>Extend the properties of exponents to rational exponents.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.N-RN.A.1.</b> Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. <i>For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3)3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</i>  Connections: 11-12.RST.4; 11-12.RST.9; 11-12.WHST.2d	A II	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.			
<b>HS.N-RN.A.2.</b> Rewrite expressions involving radicals and rational exponents using the properties of exponents.	A II	<i>HS.MP.7.</i> Look for and make use of structure.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Number and Quantity: The Real Number System (N-RN)</b> <b>Use properties of rational and irrational numbers.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.N-RN.B.3.</b> Explain why the sum or product of two rational numbers are rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.  Connection: 9-10.WHST.1e	A I	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Number and Quantity: Quantities ★ (N-Q)</b> <b>Reason qualitatively and use units to solve problems.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.N-Q.A.1.</b> Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Connections: <i>SCHS-S1C4-02; SSHS-S5C5-01</i>	A I ★	<i>HS.MP.4.</i> Model with mathematics. <i>HS.MP.5.</i> Use appropriate tools strategically. <i>HS.MP.6.</i> Attend to precision.	1.5  2.6	To demonstrate that in today's global market companies need to be aware of how currency values affect business transactions	<p>A company has a subsidiary in Mexico where the currency is in pesos. If the subsidiary earned 12,102,282 pesos in quarter 1 what would that convert to in US dollars if the conversion rate is 1 Mexican peso = 0.08 US Dollars?</p> <p><b>Solution:</b></p> $\frac{12,102,282 \text{ pesos}}{1} \cdot \frac{\$0.08 \text{ US}}{1 \text{ peso}} = \$968,182.56 \text{ US}$
<b>HS.N-Q.A.2.</b> Define appropriate quantities for the purpose of descriptive modeling. Connection: <i>SSHS-S5C5-01</i>	A I A II ★	<i>HS.MP.4.</i> Model with mathematics. <i>HS.MP.6.</i> Attend to precision.			
<b>HS.N-Q.A.3.</b> Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	A I	<i>HS.MP.5.</i> Use appropriate tools strategically. <i>HS.MP.6.</i> Attend to precision.	8.7	To determine how taxes affect payroll and overall expenses. To apply tax laws to preparing deductions for	<p><b>Question 1</b></p> <p>Using the Sample Tax Table below, find the tax for Mr. and Mrs. Larson, who are filing a joint return. Their taxable income is \$25,300.</p> <p><b>Sample Tax Table</b></p>

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

**Number and Quantity: Quantities ★ (N-Q)**

**Reason qualitatively and use units to solve problems.**

<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>																																				
			10.2	employees  To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	<table border="1"> <tr> <td>At Least</td><td>But Less Than</td><td>Single</td><td>Married Filing Jointly</td><td>Married Filing Separately</td><td>Head of a Household</td></tr> <tr> <td colspan="2"></td><td align="center" colspan="4"><b>Your tax is –</b></td></tr> <tr> <td><b>25,200</b></td><td><b>25,250</b></td><td>3,359</td><td>2,934</td><td>3,359</td><td>3,176</td></tr> <tr> <td><b>25,250</b></td><td><b>25,300</b></td><td>3,366</td><td>2,941</td><td>3,366</td><td>3,184</td></tr> <tr> <td><b>25,300</b></td><td><b>25,350</b></td><td>3,374</td><td>2,949</td><td>3,374</td><td>3,191</td></tr> <tr> <td><b>25,350</b></td><td><b>25,400</b></td><td>3,381</td><td>2,956</td><td>3,381</td><td>3,199</td></tr> </table> <p><b>Solution:</b></p> <ol style="list-style-type: none"> <li>1. First, find the 25,300-25,350 taxable income line.</li> <li>2. Next, find the column for married filing jointly.</li> <li>3. Then read down the column.</li> <li>4. The amount shown where the taxable income line and the filing status columns meet is \$2,949.</li> <li>5. This is the tax amount they should enter on their form.</li> </ol> <p><b>Question 2</b></p> <p>Using the same Sample Tax Table above, find the tax for a single person whose taxable income is \$25,300.</p> <p><b>Solution:</b></p> <p>\$3,374</p> <p><b>Project</b></p> <p>For people making the same amount, \$25,300, find the difference between a</p>	At Least	But Less Than	Single	Married Filing Jointly	Married Filing Separately	Head of a Household			<b>Your tax is –</b>				<b>25,200</b>	<b>25,250</b>	3,359	2,934	3,359	3,176	<b>25,250</b>	<b>25,300</b>	3,366	2,941	3,366	3,184	<b>25,300</b>	<b>25,350</b>	3,374	2,949	3,374	3,191	<b>25,350</b>	<b>25,400</b>	3,381	2,956	3,381	3,199
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<b>Number and Quantity: Quantities ★ (N-Q)</b> <b>Reason qualitatively and use units to solve problems.</b>					
<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>
					<p>single person and a married couple filing jointly. What is the percentage difference? Show the work.</p> <p><b>Solution:</b></p> $  \begin{array}{r}  \$ 3,374 \text{ single person} \\  - 2,949 \text{ married couple filing jointly} \\  \hline  \$ 425  \end{array}  $ <p>Single: <math>\\$3,374/\\$25,300 = .133 = 13\%</math>  Married: <math>\\$2,949/\\$25,300 = .117 = 12\%</math></p> <p>Income = \$25,300</p> <p><math>T_s = \\$3,374</math>      <math>\text{Perc}_s = \frac{3374}{25300} = 0.1334</math>  <math>T_m = \\$2,949</math>      <math>\text{Perc}_m = \frac{2949}{25300} = 0.1166</math></p> <p><math>\text{Perc}_s - \text{Perc}_m = 0.0165</math></p> <p><math>\frac{\text{Tax}_s \text{ Paid}}{\text{Income}} = \%_s</math></p> <p><math>\frac{\text{Tax}_m \text{ Paid}}{\text{Income}} = \%_m</math></p> <p><math>\%_s - \%_m = \text{difference in percent}</math></p>

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Number and Quantity: The Complex Number System (N-CN)</b> <b>Perform arithmetic operations with complex numbers.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.N-CN.A.1.</b> Know there is a complex number $i$ such that $i^2 = -1$ , and every complex number has the form $a + bi$ with $a$ and $b$ real.	A II	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.6.</i> Attend to precision.			
<b>HS.N-CN.A.2.</b> Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.  Connection: 11-12.RST.4	A II	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.N-CN.A.3.</b> Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.  Connection: 11-12.RST.3	+	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.7.</i> Look for and make use of structure.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Number and Quantity: The Complex Number System (N-CN)</b> <b>Represent complex numbers and their operations on the complex plane.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.N-CN.B.4.</b> Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.  Connection: 11-12.RST.3	+	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.N-CN.B.5.</b> Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. <i>For example,</i> $(-1 + \sqrt{3}i)^3 = 8$ <i>because</i>	+	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.7.</i> Look for and make use of structure.			

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<b>Number and Quantity: The Complex Number System (N-CN)</b> <b>Represent complex numbers and their operations on the complex plane.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
$(-1 + \sqrt{3}i)$ has modulus 2 and argument $120^\circ$ .					
<b>HS.N-CN.B.6.</b> Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.  Connection: 11-12.RST.3	+	HS.MP.2. Reason abstractly and quantitatively.			



**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Number and Quantity: The Complex Number System (N-CN)</b> <b>Use complex numbers in polynomial identities and equations.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.N-CN.C.7.</b> Solve quadratic equations with real coefficients that have complex solutions.	A II				
<b>HS.N-CN.C.8.</b> Extend polynomial identities to the complex numbers. <i>For example, rewrite <math>x^2 + 4</math> as <math>(x + 2i)(x - 2i)</math>.</i>	+	<i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.N-CN.C.9.</b> Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.  Connection: 11-12.WHST.1c	+	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.7.</i> Look for and make use of structure.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Number and Quantity: Vector and Matrix Quantities (N-VM)</b>					
<b>Represent and model with vector quantities.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.N-VM.A.1.</b> Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., $v$ , $ v $ , $  v  $ , $v$ ).	+	<i>HS.MP.4.</i> Model with mathematics.			
<b>HS.N-VM.A.2.</b> Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.	+	<i>HS.MP.2.</i> Reason abstractly and quantitatively.			
<b>HS.N-VM.A.3.</b> Solve problems involving velocity and other quantities that can be represented by vectors.  Connections: 11-12.RST.9; SCHS-S5C2-01; SCHS-S5C2-02;	+	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with			

Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

<b>Number and Quantity: Vector and Matrix Quantities (N-VM)</b> <b>Represent and model with vector quantities.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<i>SCHS-S5C2-06; 11-12.WHST.2d</i>		mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Number and Quantity: Vector and Matrix Quantities (N-VM)</b>					
<b>Perform operations on vectors.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.N-VM.B.4.</b> Add and subtract vectors.	+	<i>HS.MP.2.</i> Reason abstractly and quantitatively.			
a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.	+	<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.			
b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.	+				
<b>HS.N-VM.B.5.</b> Multiply a vector by a scalar.	+	<i>HS.MP.2.</i> Reason abstractly and quantitatively.			
a. Represent scalar multiplication graphically by scaling vectors and possibly	+	<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Number and Quantity: Vector and Matrix Quantities (N-VM)</b>					
<b>Perform operations on vectors.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) = (cv_x, cv_y)$ .		appropriate tools strategically.			
b. Compute the magnitude of a scalar multiple $cv$ using $  cv   =  c v$ . Compute the direction of $cv$ knowing that when $ c v \neq 0$ , the direction of $cv$ is either along $v$ (for $c > 0$ ) or against $v$ (for $c < 0$ ).  Connection: <i>ETHS-S6C1-03</i>	+				

## Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

<b>Number and Quantity: Vector and Matrix Quantities (N-VM)</b>					
<b>Perform operations on matrices and use matrices in applications.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.N-VM.C.6.</b> Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.  Connections: 9-10.RST.7; 9-10.WHST.2f; 11-12.RST.9; 11-12.WHST.2e; ETHS-S6C2-03	+	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.			
<b>HS.N-VM.C.7.</b> Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.  Connections: 9-10.RST.3; ETHS-S6C2-03	+	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.			
<b>HS.N-VM.C.8.</b> Add, subtract, and multiply matrices of appropriate dimensions.  Connections: 9-	+	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.	8.4          10.2	To evaluate purchasing and production decisions for a company       To utilize	In January Sam noted that his company ordered 8 SanDisk Cruzers, 12 SanDisk Sports and 6 EmTec Animals. In February the company ordered 20 SanDisk Cruzers, 24 SanDisk Sports and 10 EmTec Animals. For March the order was 6 SanDisk Cruzers, 4 SanDisk Sports and 20 EmTec Animals. Create matrices and add. What is the total order for each type of thumb drives this quarter for each?       <b>Solution:</b>

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Number and Quantity: Vector and Matrix Quantities (N-VM)</b> <b>Perform operations on matrices and use matrices in applications.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
10.RST.3; ETHS-S6C2-03		HS.MP.5. Use appropriate tools strategically.		appropriate software (word processing, spreadsheet, database, graphics, etc.)	$\begin{bmatrix} 8 \\ 12 \\ 6 \end{bmatrix} + \begin{bmatrix} 20 \\ 24 \\ 10 \end{bmatrix} + \begin{bmatrix} 6 \\ 4 \\ 20 \end{bmatrix} = \begin{bmatrix} 34 \\ 40 \\ 36 \end{bmatrix}$ <p>Each set of data is displayed in its own matrix. The matrices are of the same dimension. Add corresponding elements.</p>
<b>HS.N-VM.C.9.</b> Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.  Connections: ETHS-S6C2-03; 9-10.WHST.1e	+	HS.MP.2. Reason abstractly and quantitatively.  HS.MP.6. Attend to precision.			
<b>HS.N-VM.C.10.</b> Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of	+	HS.MP.2. Reason abstractly and quantitatively.  HS.MP.6. Attend to precision.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Number and Quantity: Vector and Matrix Quantities (N-VM)</b> <b>Perform operations on matrices and use matrices in applications.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.					
<b>HS.N-VM.C.11.</b> Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors. Connections: <i>ETHS-S6C1-03; 11-12.WHST.1a</i>	+	<i>HS.MP.4.</i> Model with mathematics. <i>HS.MP.5.</i> Use appropriate tools strategically.			
<b>HS.N-VM.C.12.</b> Work with $2 \times 2$ matrices as transformations of the plane, and interpret the absolute value of the determinant in	+	<i>HS.MP.4.</i> Model with mathematics. <i>HS.MP.5.</i> Use appropriate tools strategically.			



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terms of area. Connection: <i>ETHS-S6C1-03</i>					

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Algebra: Seeing Structure in Expressions (A-SSE)</b>					
<b>Interpret the structure of expressions.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
<b>HS.A-SSE.A.1.</b> Interpret expressions that represent a quantity in terms of its context.	A I ★	HS.MP.1. Make sense of problems and persevere in solving them.  HS.MP.2. Reason abstractly and quantitatively.			
a. Interpret parts of an expression, such as terms, factors, and coefficients. Connection: 9-10.RST.4	A I ★	HS.MP.4. Model with mathematics.  HS.MP.7. Look for and make use of structure.			
b. Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example, interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</i>	A I ★				
<b>HS.A-SSE.A.2.</b> Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 -</math></i>		HS.MP.2. Reason abstractly and quantitatively.  HS.MP.7. Look for and make use of structure.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Algebra: Seeing Structure in Expressions (A-SSE)</b> <b>Interpret the structure of expressions.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
$(y^2)^2$ , thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$ .					

<b>Algebra: Seeing Structure in Expressions (A-SSE)</b> <b>Write expressions in equivalent forms to solve problems.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
<b>HS.A-SSE.B.3.</b> Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Connections: 9-10.WHST.1c; 11-12.WHST.1c	A I A II ★	HS.MP.1. Make sense of problems and persevere in solving them.  HS.MP.2. Reason abstractly and quantitatively.	9.1  9.4   10.2	To use formulas to compute financial information for businesses and individuals   To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	The annual interest rate is 15%. The expression to compute interest is $1.15^t$ which can be rewritten as $\left(1.15^{\frac{1}{12}}\right)^{12t}$ .  What is the approximate equivalent?  <b>Solution:</b>  $1.012^{12t}$
a. Factor a quadratic expression to reveal the zeros of	A I ★	HS.MP.4. Model with mathematics.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Algebra: Seeing Structure in Expressions (A-SSE)</b> <b>Write expressions in equivalent forms to solve problems.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
the function it defines.					
b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.	A I ★	HS.MP.7. Look for and make use of structure.			
c. Use the properties of exponents to transform expressions for exponential functions. <i>For example the expression <math>1.15^t</math> can be rewritten as <math>(1.15^{1/12})^{12t} \approx 1.012^{12t}</math> to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</i>	A I A II ★				
<b>HS.A-SSE.B.4.</b> Derive the formula for the sum of a finite geometric series	A II ★	HS.MP.3. Construct viable arguments and critique the			

Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

<b>Algebra: Seeing Structure in Expressions (A-SSE)</b> <b>Write expressions in equivalent forms to solve problems.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
(when the common ratio is not 1), and use the formula to solve problems. <i>For example, calculate mortgage payments.</i> Connection: 11-12.RST.4		reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.7.</i> Look for and make use of structure.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Algebra: Arithmetic with Polynomials and Rational Expressions (A-APR)</b> <b>Perform arithmetic operations on polynomials.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.A-APR.A.1.</b> Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.  Connection: 9-10.RST.4	A I				

<b>Algebra: Arithmetic with Polynomials and Rational Expressions (A-APR)</b> <b>Understand the relationship between zeros and factors of polynomials.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.A-APR.B.2.</b> Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number $a$ , the remainder on	A II	<b>HS.MP.2.</b> Reason abstractly and quantitatively.  <b>HS.MP.3.</b> Construct viable arguments and critique the			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Algebra: Arithmetic with Polynomials and Rational Expressions (A-APR)</b>					
<b>Understand the relationship between zeros and factors of polynomials.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
division by $x - a$ is $p(a)$ , so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$ .		reasoning of others.			
<b>HS.A-APR.B.3.</b> Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	A I A II	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Algebra: Arithmetic with Polynomials and Rational Expressions (A-APR)</b> <b>Use polynomial identities to solve problems.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.A-APR.C.4.</b> Prove polynomial identities and use them to describe numerical relationships. <i>For example, the polynomial identity <math>(x^2+y^2)^2 = (x^2-y^2)^2 + (2xy)^2</math> can be used to generate Pythagorean triples.</i>	A II	<i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			
<b>HS.A-APR.C.5.</b> Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of $x$ and $y$ for a positive integer $n$ , where $x$ and $y$ are any numbers, with coefficients determined for example by Pascal's Triangle. (The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.)	+	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.			



**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Algebra: Arithmetic with Polynomials and Rational Expressions (A-APR)</b>					
<b>Rewrite rational expressions.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.A-APR.D.6.</b> Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$ , where $a(x)$ , $b(x)$ , $q(x)$ , and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.	A II	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.A-APR.D.7.</b> Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add,	+	<i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			

Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

<b>Algebra: Arithmetic with Polynomials and Rational Expressions (A-APR)</b> <b>Rewrite rational expressions.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
subtract, multiply, and divide rational expressions.					

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Algebra: Creating Equations ★ (A-CED)</b> <b>Create equations that describe numbers or relationships.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.A-CED.A.1.</b> Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i>	A I A II ★	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.	1.5          10.2	To determine how costs affect decision making for businesses      To utilize appropriate software to generate business reports	<b>Question 1</b>  After a soft drink maker includes a \$1.00 rebate offer on each 24-pack, sales increase by 180,000 packs or 15% over the previous quarter. If 2% of the possible rebates are redeemed, how much will the company have to pay out in rebates?  <b>Solution:</b>  $\begin{array}{l} \text{Let } X = \text{number of packs sold in previous quarter.} \\ .15 X = 180,000 \\ \text{Divide both sides by } .15 \\ X = 1,200,000 \end{array}$ $\begin{array}{r} \text{This quarter, the soft-drink maker sold} \\ 1,200,000 \\ + \quad 180,000 \\ \hline 1,380,000 \text{ packs} \end{array}$ $1,380,000 \times \$1.00 \times .02 (2\%) = \$27,600$  <b>Question 2</b>  If the soft drink maker earns a profit of \$0.75 per 24-pack sold before the rebates are paid out, how much will the company make or lose as a result of the rebate promotion?  <b>Solution:</b>



**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Algebra: Creating Equations ★ (A-CED)</b> <b>Create equations that describe numbers or relationships.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<i>nutritional and cost constraints on combinations of different foods.</i>					$10x + 12y \leq 5000$  $10x + 10y = 4500$ $(-)\underline{10x + 12y = 5000}$ $-2y = -500$ $y = 250$ $x = 200$
<b>HS.A-CED.A.4.</b> Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i>	A I ★	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.7.</i> Look for and make use of structure.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.A-REI.A.1.</b> Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	A I A II	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.A-REI.A.2.</b> Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	A II	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.7.</i> Look for and make use of structure.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Algebra: Reasoning with Equations and Inequalities ★ (A-REI)</b> <b>Solve equations and inequalities in one variable.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
<b>HS.A-REI.B.3.</b> Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	A I	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			
<b>HS.A-REI.B.4.</b> Solve quadratic equations in one variable.	A I A II	<i>HS.MP.2.</i> Reason abstractly and quantitatively.			
a. Use the method of completing the square to transform any quadratic equation in $x$ into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.	A I	<i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			
b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$ ), taking	A I A II				

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Algebra: Reasoning with Equations and Inequalities ★ (A-REI)</b> <b>Solve equations and inequalities in one variable.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers $a$ and $b$ .					

<b>Algebra: Reasoning with Equations and Inequalities ★ (A-REI)</b> <b>Solve systems of equations.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.A-REI.C.5.</b> Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a	A /	<b>HS.MP.2.</b> Reason abstractly and quantitatively.  <b>HS.MP.3.</b> Construct viable arguments and critique the reasoning of others.			



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<b>Algebra: Reasoning with Equations and Inequalities ★ (A-REI)</b>					
<b>Solve systems of equations.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
system with the same solutions.					
<b>HS.A-REI.C.6.</b> Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.  Connection: <i>ETHS-S6C2-03</i>	A I A II	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.	9.3          10.2	To analyze how costs affect a store's revenue potential          To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	During the busy holiday season, a store manager hires temporary workers, some who will work part-time and others who will work full-time. <ul style="list-style-type: none"> <li>The part-time employees will work 30 hours per week at \$8.00 per hour.</li> <li>The full-time employees will work 40 hours per week at \$10.00 per hour.</li> </ul> The manager hires 14 people and figures that the added staff will cost \$4,320 per week. How many part-time workers (PT) and how many full-time workers (FT) did she hire?  <b>Solution:</b>  Let x = part-time workers Let y = full-time workers Each part-time worker will earn \$240 per week. Each full-time worker will earn \$400 per week.  $x + y = 14$ $240x + 400y = 4320$ Multiply the equation by -240 $-240x - 240y = -3360$ $240x + 400y = 4320$  Subtract the bottom from the top. $0x + 160y = 960$ Divide by 160 $y = 6$  The manager hired 6 full time workers and therefore had to hire 8 part-time workers.

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Algebra: Reasoning with Equations and Inequalities ★ (A-REI)</b>					
<b>Solve systems of equations.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.A-REI.C.7.</b> Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. <i>For example, find the points of intersection between the line <math>y = -3x</math> and the circle <math>x^2 + y^2 = 3</math>.</i>	A II	<i>HS.MP.2.</i> Reason abstractly and quantitatively. <i>HS.MP.4.</i> Model with mathematics. <i>HS.MP.5.</i> Use appropriate tools strategically. <i>HS.MP.6.</i> Attend to precision. <i>HS.MP.7.</i> Look for and make use of structure. <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			
<b>HS.A-REI.C.8.</b> Represent a system of linear equations as a single matrix equation in a vector variable.	+				
<b>HS.A-REI.C.9.</b> Find the inverse of a matrix if it exists, and use it to solve	+	<i>HS.MP.5.</i> Use appropriate tools strategically.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

**Algebra: Reasoning with Equations and Inequalities ★ (A-REI)**

**Solve systems of equations.**

<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
systems of linear equations (using technology for matrices of dimension $3 \times 3$ or greater).  Connection: <i>ETHS-S6C2-03</i>		<i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.			

**Algebra: Reasoning with Equations and Inequalities ★ (A-REI)**

**Represent and solve equations and inequalities graphically.**

<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
<b>HS.A-REI.D.10.</b> Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	A I	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.			
<b>HS.A-REI.D.11.</b> Explain why the x-coordinates of the points where the graphs of the equations	A I A II ★	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Algebra: Reasoning with Equations and Inequalities ★ (A-REI)</b> <b>Solve systems of equations.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
$y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. Connection: <i>ETHS-S6C2-03</i>		mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.			
<b>HS.A-REI.D.12.</b> Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of	A I	<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.			

Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

<b>Algebra: Reasoning with Equations and Inequalities ★ (A-REI)</b> <b>Solve systems of equations.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
linear inequalities in two variables as the intersection of the corresponding half-planes.					

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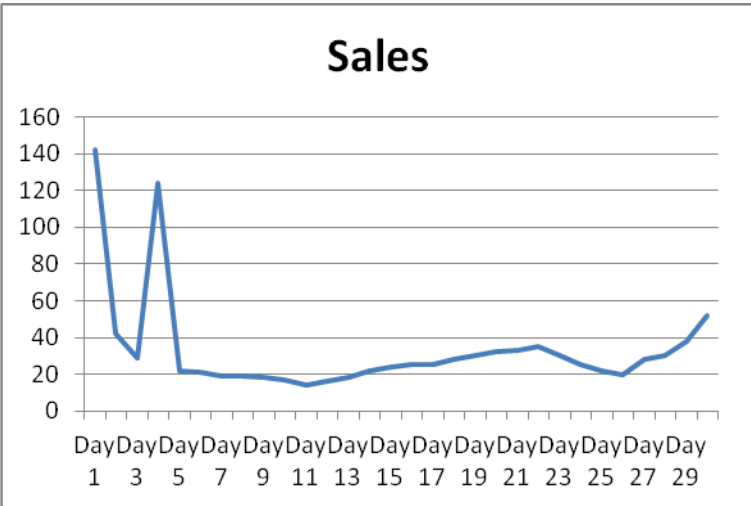
<b>Functions: Interpreting Functions (F-IF)</b> <b>Understand the concept of a function and use of function notation.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.F-IF.A.1.</b> Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$ . The graph of $f$ is the graph of the equation $y = f(x)$ .	A I	<i>HS.MP.2.</i> Reason abstractly and quantitatively.			
<b>HS.F-IF.A.2.</b> Use function notations, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.  Connection: 9-10.RST.4	A I	<i>HS.MP.2.</i> Reason abstractly and quantitatively.			

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<b>HS.F-IF.A.3.</b> Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. <i>For example, the Fibonacci sequence is defined recursively by <math>f(0) = f(1) = 1</math>, <math>f(n+1) = f(n) + f(n-1)</math> for <math>n \geq 1</math>.</i>	A I A II	<i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			

<b>Functions: Interpreting Functions (F-IF)</b> <b>Interpret functions that arise in applications in terms of context.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
<b>HS.F-IF.B.4.</b> For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs	A I A II ★	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.	1.4          10.2	To analyze how different variables can affect the cash flow of a company by creating graphs and tables      To utilize appropriate	<b>Project</b>  Start on Black Friday as Day 1 and assume a 30-day Christmas shopping period. The data is also confined to the statistical sample of sales of 1,000 items.  1. Create a graph of the number of items sold on each day of the shopping season. 2. Identify intervals where the graph is increasing and decreasing. 3. Identify the maximums and minimums. 4. Using knowledge of modern business, explain the spike on the 4 <sup>th</sup> day of

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showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i>  Connections: <i>ETHS-S6C2.03; 9-10.RST.7; 11-12.RST.7</i>		HS.MP.6. Attend to precision.		software to generate graphs	<div>sales.</div> <div>Solution:</div> <div>1.</div> <div><div><div>Sales</div></div><div>2.</div><table><tr><td>Day 1</td><td>142</td></tr><tr><td>Day 2</td><td>42</td></tr><tr><td>Day 3</td><td>29</td></tr><tr><td>Day 4</td><td>124</td></tr><tr><td>Day 5</td><td>22</td></tr><tr><td>Day 6</td><td>21</td></tr><tr><td>Day 7</td><td>19</td></tr></table></div>	Day 1	142	Day 2	42	Day 3	29	Day 4	124	Day 5	22	Day 6	21	Day 7	19
Day 1	142																		
Day 2	42																		
Day 3	29																		
Day 4	124																		
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					Day 8	19
					Day 9	18
					Day 10	17
					Day 11	14
					Day 12	16
					Day 13	18
					Day 14	22
					Day 15	24
					Day 16	25
					Day 17	25
					Day 18	28
					Day 19	30
					Day 20	32
					Day 21	33
					Day 22	35
					Day 23	30
					Day 24	25
					Day 25	22
					Day 26	20
					Day 27	28
					Day 28	30
					Day 29	38
					Day 30	52
					Decreases from Day 1 to Day 3. Increases from Day 3 to Day 4.	

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<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>
					<p>Decreases from Day 4 to Day 11.  Increases from Day 11 to Day 22.  Decreases from Day 22 to Day 26.  Increases from Day 26 to Day 30.</p> <p>3. Maximum: 142  Minimum: 14</p> <p>4. The Monday after Black Friday is known as Cyber Monday. Cyber Monday is the busiest on-line shopping day of the year.</p>
<b>HS.F-IF.B.5.</b> Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble <math>n</math> engines in a factory, then the positive integers would be an appropriate domain for the function.</i>  Connection: 9-10.WHST.2f	A I ★	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.6.</i> Attend to precision.			
<b>HS.F-IF.B.6.</b>	A I	<i>HS.MP.2.</i> Reason			

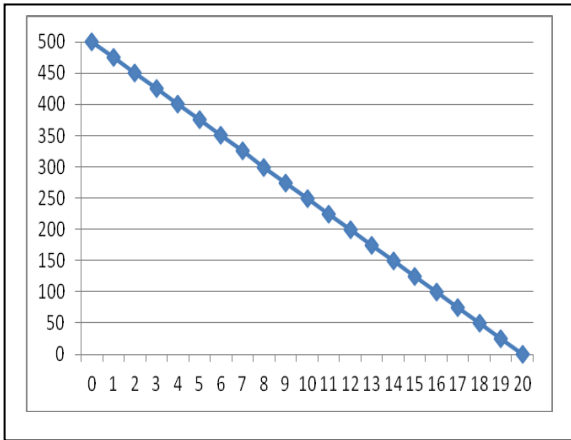
Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

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<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.  Connections: <i>ETHS-S1C2-01; 9-10.RST.3</i>	A II ★	abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.			

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<b>HS.F-IF.C.7.</b> Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.	A I	<i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.	1.5	To analyze and determine the future value of money and how it affects a company's growth	<b>Project:</b> Linear graph (a.)  Sal purchases an iPad for \$500 with his new VISA. The current promotion waives the 29.9% AYP on the first purchase. He pays the minimum monthly payments of \$25.  <div>1. Create a formula to show the running balance per month.</div> <div>2. How long will it take Sal to pay off the iPad?</div> <div>3. Create a graph to display the information.</div> <b>Solution:</b>  <div>1. Previous Balance – Payment = Current Balance</div> <div>2. <math>Y = \\$500 - \\$25X</math></div> <table><tr><th>X</th><th>Y</th></tr><tr><td>0</td><td>500</td></tr><tr><td>1</td><td>475</td></tr><tr><td>2</td><td>450</td></tr><tr><td>3</td><td>425</td></tr><tr><td>4</td><td>400</td></tr><tr><td>5</td><td>375</td></tr><tr><td>6</td><td>350</td></tr><tr><td>7</td><td>325</td></tr><tr><td>8</td><td>300</td></tr><tr><td>9</td><td>275</td></tr><tr><td>10</td><td>250</td></tr><tr><td>11</td><td>225</td></tr><tr><td>12</td><td>200</td></tr><tr><td>13</td><td>175</td></tr><tr><td>14</td><td>150</td></tr></table>	X	Y	0	500	1	475	2	450	3	425	4	400	5	375	6	350	7	325	8	300	9	275	10	250	11	225	12	200	13	175	14	150
	X		Y																																		
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9	275																																				
10	250																																				
11	225																																				
12	200																																				
13	175																																				
14	150																																				
A II		9.4																																			
+																																					
★																																					
			10.2	To use appropriate hardware and software to generate business document/ reports																																	

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					<table><tr><td>15</td><td>125</td></tr><tr><td>16</td><td>100</td></tr><tr><td>17</td><td>75</td></tr><tr><td>18</td><td>50</td></tr><tr><td>19</td><td>25</td></tr><tr><td>20</td><td>0</td></tr></table> <p>Sal will pay off the iPad in 20 months.</p> <p>3. Graph</p> 	15	125	16	100	17	75	18	50	19	25	20	0
15	125																
16	100																
17	75																
18	50																
19	25																
20	0																
a. Graph linear and quadratic functions and show intercepts, maxima, and	A I ★																


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minima.  Connections: <i>ETHS-S6C1-03</i> ; <i>ETHS-S6C2-03</i>					
b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.  Connections: <i>ETHS-S6C1-03</i> ; <i>ETHS-S6C2-03</i>	A I ★				
c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.  Connections: <i>ETHS-S6C1-03</i> ; <i>ETHS-S6C2-03</i>  <i>Continued on next</i>	A II ★				

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<i>page</i>					
d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.  Connections: <i>ETHS-S6C1-03</i> ; <i>ETHS-S6C2-03</i>	+ ★				
e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.  Connections: <i>ETHS-S6C1-03</i> ; <i>ETHS-S6C2-03</i>	A II ★				<b>Project:</b> Exponential graph (e.)  According to Moore's Law, the number of transistors that can fit on a chip will double every 18 months due to advancements in technology. The first chip in January 1, 1970, could fit 8 transistors.  1. Create a chart showing increments of 18 months and the number of transistors that fit on a chip accordingly, starting with January 1, 1970, and ending January 1, 1982.  <b>Solution:</b>

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<b>HS.F-IF.C.8.</b> Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.  Connection: 11-12.RST.7	A I A II	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.7.</i> Look for and make use of structure.			
a. Use the process of factoring and completing the square in a quadratic	A I				



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function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.  Connection: 11-12.RST.7					
b. Use the properties of exponents to interpret expressions for exponential functions. <i>For example, identify percent rate of change in functions such as <math>y = (1.02)^t</math>, <math>y = (0.97)^t</math>, <math>y = (1.01)^{12t}</math>, <math>y = (1.2)^{t/10}</math>, and classify them as representing exponential growth or decay.</i>  Connection: 11-	A II				

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12.RST.7					
<b>HS.F-IF.C.9.</b> Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). <i>For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</i>  Connections: <i>ETHS-S6C1-03; ETHS-S6C2-03; 9-10.RST.7</i>	A I A II	<i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.			

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<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>
<b>HS.F-BF.A.1.</b> Write a function that describes a relationship between two quantities.  Connections: <i>ETHS-S6C1-03; ETHS-S6C2-03</i>	A I A II + ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.	8.5	To evaluate the overall cost of credit to a business	A businessman takes out a short-term loan from a friendly and enterprising lender. The lender proposes an interesting agreement. There will be no compounding of interest of any kind. <ul style="list-style-type: none"> <li>If the borrower repays the loan in the first month after receiving it, he owes nothing but the principal.</li> <li>If he pays it off in the second month, he owes the principal plus one percent of the principal.</li> <li>If it is paid off in the third month, he owes the principal plus two percent of the principal, and so on.</li> </ul> According to the agreement, he must pay all of the principal and whatever interest is owed all at once; he cannot make partial payments. <b>Solution:</b> A = Amount paid back P = Principal N = number of month in which it is paid back $A = f(n) = P(1 + (.01)(n-1))$ If it is paid off in the 3 <sup>rd</sup> month, the interest is 2% (.02); if it is paid off in the 30 <sup>th</sup> month, the interest is 29% (.29). Subtract one month from n then multiply it by .01 to get the correct interest rate. Then add that to 1 and multiply by the principal to get the amount that is owed.  Note that if it is paid off in the 1 <sup>st</sup> month, the equation is $A = P(1 + (.01)(1-1)) \text{ or } A = P(1 + 0) = P$
		<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.	9.3   10.2	To utilize appropriate software to generate graphs	
a. Determine an	A I				

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explicit expression, a recursive process, or steps for calculation from a context.  Connections: <i>ETHS-S6C1-03; ETHS-S6C2-03; 9-10.RST.7; 11-12.RST.7</i>	A II ★				
b. Combine standard function types using arithmetic operations. <i>For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.</i>  Connections: <i>ETHS-S6C1-03;</i>	A II ★				

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<i>ETHS-S6C2-03</i>  <i>Continued on next page</i>					
c. Compose functions. For example, if $T(y)$ is the temperature in the atmosphere as a function of height, and $h(t)$ is the height of a weather balloon as a function of time, then $T(h(t))$ is the temperature at the location of the weather balloon as a function of time.  Connections: <i>ETHS-S6C1-03</i> ; <i>ETHS-S6C2-03</i>	+ ★				
<b>HS.F-BF.A.2.</b> Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model	A II ★	<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.			A recursive sequence uses the preceding number in the sequence to determine the next number.  <b>Question 1:</b>  Jose believes he can successfully sell vacuum cleaners on commission. He is told by the Acme Vacuum Cleaner, Inc., that all new sales staff must prove their

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situations, and translate between the two forms.		HS.MP.8. Look for and express regularity in repeated reasoning.			<p>capability before they will be allowed to share in a full commission of \$60 per unit. Acme's sales manager explains that each new sales staff member will be paid sixty cents as commission for the first vacuum cleaner he or she sells and that the commission increases by twenty cents for each successive unit sold by the sales trainee, topping out at \$60 per unit.</p> <p>What would Jose's commission be after he has sold 5 units?</p> <p><b>Solution:</b></p> <p>Use a recursive formula for determining a geometric sequence. The formula is:</p> $a_n = a_{n-1} + d$ <p><math>a_n</math> = the nth number being sought  <math>a_{n-1}</math> = the number in the sequence immediately preceding <math>a_n</math>  <math>d</math> = the constant difference between each number in the sequence</p> <p>The formula therefore reads:</p> $a_5 = a_{5-1} + \$0.20$ $a_5 = a_4 + \$0.20$ <p>Since the 4<sup>th</sup> number in the sequence is \$1.20, <math>a_4 = \\$1.20</math></p> $a_5 = \$1.20 + \$0.20$ $a_5 = \$1.40$ <p><b>Question 2</b></p>

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					<p>Using the profit plan in the previous example, Jose figures he can sell 10 vacuum cleaners per week and wants to know how much profit he will earn per unit after he has sold 100 units.</p> <p><b>Solution:</b></p> <p>Use the explicit version of the arithmetic sequence formula to calculate this. The formula is:</p> $a_n = a_1 + (n-1)d$ <p>Let <math>n = 100</math>  Let <math>a_1 = \\$0.60</math>  Let <math>d = \\$0.20</math></p> <p><math>a_{100} = \\$0.60 + (100 - 1)\\$0.20</math>  <math>A_{100} = \\$0.60 + (99)\\$0.20</math></p> <p><math>A_{100} = \\$0.60 + \\$19.80</math></p> <p><math>A_{100} = \\$20.40</math></p> <p>Jose will receive a profit of \$20.40 on his 100<sup>th</sup> unit.</p> <p><b>Question 3</b></p> <p>Tony is approached by a representative of Faceplant.com, a social networking company which is seeking advertisement revenue. Faceplant.com offers Tony a commission of 20% on every \$100 advertisement unit he sells. Calculating, Tony figures that after selling 100 \$100 advertisement units, he would receive \$2,000.</p>

Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

<b>Functions: Building Functions (F-BF)</b> <b>Build a function that models a relationship between two quantities.</b>					
<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>
					<p>Tony instead suggests that Faceplant.com pay him \$.01 on the first \$100 advertisement unit and that the commission increase by a factor of 15% with each additional advertisement unit sold.</p> <p>Which is the better deal for Tony, the Faceplant.com original offer or Tony's counter-offer?</p> <p><b>Solution:</b></p> <p>Use the explicit formula for a geometric sequence to calculate how much commission Tony will receive on the 100<sup>th</sup> advertisement unit. The formula is as follows:</p> $a_n = a_1 * r^{n-1}$ <p>Let n = 100 and r = 1.15</p> $a_{100} = \$0.01 * 1.15^{100-1}$ $a_{100} = \$0.01 * 1.15^{99}$ $a_{100} = \$0.01 * 1021142.131$ $a_{100} = \$10,211.42$ <p>The better deal for Tony is his counter-offer (\$10,211.42 commission for the 100<sup>th</sup> unit vs. \$2,000.00).</p>



**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Functions: Building Functions (F-BF)</b> <b>Build new functions from existing functions.</b>					
<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>
<b>HS.F-BF.B.3.</b> Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$ , $k f(x)$ , $f(kx)$ , and $f(x + k)$ for specific values of $k$ (both positive and negative); find the value of $k$ given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i>  Connections: <i>ETHS-S6C2-03; 11-12.WHST.2e</i>	A I A II	<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.F-BF.B.4</b> Find inverse functions. Connection: <i>ETHS-S6C2-03</i>	A II +	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with			
a. Solve an equation of the	A II				

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

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<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
form $f(x) = c$ for a simple function $f$ that has an inverse and write an expression for the inverse. <i>For example, <math>f(x) = 2x^3</math> or <math>f(x) = (x+1)/(x-1)</math> for <math>x \neq 1</math>.</i>		mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.7.</i> Look for and make use of structure.			
b. Verify by composition that one function is the inverse of another.	+				
c. Read values of an inverse function from a graph or a table, given that the function has an inverse.	+				
d. Produce an invertible function from a non-invertible function by restricting the domain.	+				
<b>HS.F-BF.B.5.</b> Understand the inverse relationship	+	<i>HS.MP.2.</i> Reason abstractly and	1.5 9.1	To assess long-term costs and to determine the	A woman buys a new machine for her business for \$80,000. It depreciates 12% per year. When it gets down to a value of \$24,000, it must be replaced. How long will that be?

Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

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between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.  Connection: <i>ETHS-S6C2-03</i>		quantitatively.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.	10.2	value of assets at a given point in time  To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	<b>Solution:</b>  $\$24,000 = \$80,000 (.88)^t$ $\frac{24,000}{80,000} = \frac{80,000}{80,000}$ $.3 = (.88)^t$ $\log_{.88} .3 = \log_{.88} (.88)^t$ $t = 9.4 \text{ years}$  The machine must be replaced in 9.4 years.

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

**Functions: Linear, Quadratic, and Exponential Models ★ (F-LE)**

**Construct and compare linear, quadratic, and exponential models and solve problems.**

<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
<b>HS.F-LE.A.1.</b> Distinguish between situations that can be modeled with linear functions and with exponential functions.  Connections: <i>ETHS-S6C2-03;</i> <i>SSHS-S5C5-03</i>	A I ★	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.	1.5 7.1       10.2	To analyze the cost of money over a specific time period and determine the best choice for a business     To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	<b>Question 1:</b>  The law firm of Dewy, Cheetem, and Howe is researching three wireless cell phone providers to determine which company offers the least expensive plan for the firm's cell phones. The three cell phone companies offer the following plans:  Company A: \$750 per month with a 5-cent per minute usage fee.  Company B: \$500 per month with a 10-cent per minute usage fee.  Company C: \$0 per month with a 20-cent per minute usage fee.  1. Create three equations that will show the total monthly cost of each plan based upon the minutes used. 2. Determine the monthly cost of each plan based on 1,000 minutes, 5,000 minutes, and 10,000 minutes of monthly usage. 3. Create a graph to display the information. 4. Which plan is the best deal at 1,000, 5,000, and 10,000 minutes?  <b>Solution:</b>  1.  Total Monthly Cost = y Total Monthly Minutes = x  <div style="display: flex; justify-content: space-around;"> <div> <u>Company A</u>   <math>y = .05x + 750</math> </div> <div> <u>Company B</u>   <math>y = .1x + 500</math> </div> <div> <u>Company C</u>   <math>y = .2x + 0</math> </div> </div> 2.

Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

**Functions: Linear, Quadratic, and Exponential Models ★ (F-LE)**

Construct and compare linear, quadratic, and exponential models and solve problems.

<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>																								
					<p>Inserting x values of 1,000, 5,000, and 10,000 and solving for y yields the following y coordinates for each of the three companies. These y values represent the total monthly cost of each cell phone plan:</p> <table> <thead> <tr> <th><u>x</u></th><th><u>y</u></th><th><u>x</u></th><th><u>y</u></th><th><u>x</u></th><th><u>y</u></th></tr> </thead> <tbody> <tr> <td>1,000</td><td>800</td><td>1,000</td><td>600</td><td>1,000</td><td>200</td></tr> <tr> <td>5,000</td><td>1,000</td><td>5,000</td><td>1,000</td><td>5,000</td><td>1,000</td></tr> <tr> <td>10,000</td><td>1,250</td><td>10,000</td><td>1,500</td><td>10,000</td><td>2,000</td></tr> </tbody> </table> <p>3.</p> <p>Plot the x and y values on an xy coordinate chart as follows:</p>	<u>x</u>	<u>y</u>	<u>x</u>	<u>y</u>	<u>x</u>	<u>y</u>	1,000	800	1,000	600	1,000	200	5,000	1,000	5,000	1,000	5,000	1,000	10,000	1,250	10,000	1,500	10,000	2,000
<u>x</u>	<u>y</u>	<u>x</u>	<u>y</u>	<u>x</u>	<u>y</u>																								
1,000	800	1,000	600	1,000	200																								
5,000	1,000	5,000	1,000	5,000	1,000																								
10,000	1,250	10,000	1,500	10,000	2,000																								

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Functions: Linear, Quadratic, and Exponential Models ★ (F-LE)</b> <b>Construct and compare linear, quadratic, and exponential models and solve problems.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
					<p>4.</p> <p>At 1,000 minutes, Company C is the best deal.  At 5,000 minutes, they are all the same.  At 10,000 minutes, Company A is the best deal.</p> <p><b>Question 2</b></p> <p>Mercedes is the lending manager of the Medici Business Bank (MBB). A new business client, Oil Wildcatter Explorations (OWE), wants to borrow, unsecured, \$10 million for off-shore oil exploration in the Gulf of California. Since an unsecured loan is risky, Mercedes proposes lending this sum at a rate of 17 % interest compounded monthly, provided that principal and interest are paid back in monthly installments over a five year period, with no balloon payment at the end.</p> <ol style="list-style-type: none"> <li>Create an equation that shows the total return of principal plus interest after 5 years.</li> <li>Create a chart showing the payback of principal plus interest over the 5 year period.</li> </ol> <p><b>Solution:</b></p> <ol style="list-style-type: none"> <li>Use these variables: (a) A = Ending Amount; (b) P = beginning amount; (c) r = interest; (d) n = number of times interest is compounded per year; and (e) t = time in years</li> </ol> <p>The equation is as follows:</p>

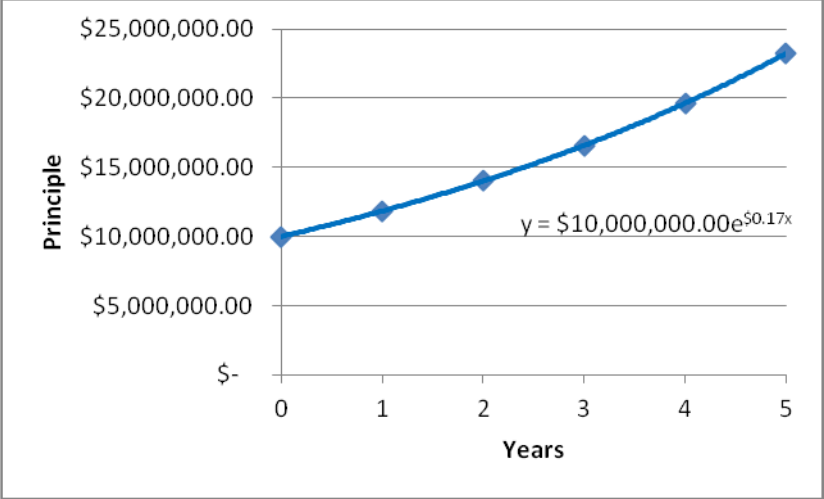
**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

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<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
					$A = P(1 + r/n)^{nt}$ <p>Solve for A. The other variables will have the following values:</p> <p><math>P = \\$10,000,000</math>; <math>r = .17</math>; <math>n = 12</math>; and <math>t = 5</math></p> <p>Solving:</p> $A = P(1 + r/n)^{nt}$ $A = 10,000,000(1 + .17/12)^{12*5}$ $A = 10,000,000(1 + .0141666667)^{12*5}$ $A = 10,000,000(1.0141666667)^{12*5}$ $A = 10,000,000(1.0141666667)^{60}$ $A = 10,000,000(2.325733406)$ $A = \$23,257,334.06$ <p>2. The chart below shows the exponential increase in principal and interest over the five years of the loan:</p>

Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

**Functions: Linear, Quadratic, and Exponential Models ★ (F-LE)**

Construct and compare linear, quadratic, and exponential models and solve problems.

<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>
					 <p><b>Question 3</b></p> <ol style="list-style-type: none"> <li>1. In the chart above, the value of principal and interest starts at \$10 million and increases at a steeper slope over time. How is this increase described?</li> <li>2. What is the term for a slope that is decreasing exponentially?</li> <li>3. What factor holds constant over time?</li> </ol> <p><b>Solution:</b></p> <ol style="list-style-type: none"> <li>1. Exponential growth</li> <li>2. Exponential decay</li> <li>3. The rate of increase</li> </ol>
a. Prove that linear functions grow	AI ★				



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<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.  Connection: 11-12.WHST.1a-1e					
b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.  Connection: 11-12.RST.4	A I ★				
c. Recognize situations in which a quantity grows or decays by a constant percent rate per	A I ★				

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

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<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
unit interval relative to another.  Connections: <i>ETHS-S6C1-03; ETHS-S6C2-03; 11-12.RST.4</i>					
<b>HS.F-LE.A.2.</b> Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).  Connections: <i>ETHS-S6C1-03; ETHS-S6C2-03; 11-12.RST.4; SSHS-S5C5-03</i>	A I A II ★	<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.	8.5           9.3           10	To analyze and prepare budgets for an organization to implement cost-saving measures   To prepare cost analyses and determine the best choice for a business   To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	An employer will be hiring new employees, but first she has to determine which of the following salary options would save her company money. Option 1 is starting at \$40,000 a year and receiving a \$5,000 raise each year. Option 2 is starting at \$40,000 and receiving a 10% raise each year.  1. How much would Option 1 cost in the 10th year? 2. How much would Option 2 cost in the 10th year? 3. How much would Option 1 cost over ten years total? 4. How much would Option 2 cost over ten years total?  <b>Solution:</b>  1. \$90,000 Principal + (raise x number of years) $P + r(n)$  2. \$103,749.70 $P(1 + r)^n$ $40,000(1 + .10)^{10} = \$103,749.70$  3. \$650,000 $\left(\frac{a + L}{2}\right)^n$

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

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					$\left(\frac{First + Last}{2}\right)(10) = \left(\frac{40,000 + 90,000}{2}\right)(10)$ $(\$65,000)(10) = \$650,000$ <p>4. \$637,496.98</p> <p>The formula for determining how much Option 2 would cost over 10 years total is:</p> $P[(((1+r)^t - 1)t]$
<b>HS.F-LE.A.3.</b> Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	A I ★	<b>HS.MP.2.</b> Reason abstractly and quantitatively.			
<b>HS.F-LE.A.4.</b> For exponential models, express as a logarithm the solution to $ab^{ct} = d$	A II ★	<b>HS.MP.7.</b> Look for and make use of structure.	8.5  9.3	To determine the growth of investments at specific points in time	At what rate of continuously compounded interest would an initial investment of \$9,000 triple in 15 years?  <b>Solution:</b>

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

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<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
where $a$ , $c$ , and $d$ are numbers and the base $b$ is 2, 10, or $e$ ; evaluate the logarithm using technology.  Connections: <i>ETHS-S6C1-03; ETHS-S6C2-03; 11-12.RST.3</i>			10.2	To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	In 15 years, the \$9,000 will have become \$27,000.  $27,000 = 9,000e^{xt}$  $x$ is the rate and $t = 15$ . Thus, $27,000 = 9,000e^{x \cdot 15}$  Divide by 9,000 and get $3 = e^{15x}$  $\ln 3 = \ln(e^{15x}) = 15x$ $1.09861 = 15x$ $x = .0732$ $x = 7.3\%$ interest

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Functions: Linear, Quadratic, and Exponential Models ★ (F-LE)</b> <b>Interpret expressions for functions in terms of the situation they model.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
<b>HS.F-LE.B.5.</b> Interpret the parameters in a linear or exponential function in terms of a context.  Connections: <i>ETHS-S6C1-03; ETHS-S6C2-03;SSHS-S5C5-03; 11-12.WHST.2e</i>	A I A II ★	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.	9.5	To understand the variables in the growth of money and how each variable works	<b>Question 1</b>  Joseph buries \$1,000 in his backyard and deposits \$1,000 in a bank with a 3% simple annual interest.  Write an equation that represents the total amount of money he has at time $n$ . Show how the base and vertical shift are displayed in the explicit form of the function.  <b>Solution:</b>  The variables are as follows: $A$ = Final value of the investment; $P$ = Initial value of the investment; $n$ = number of interest periods in years; $r$ = rate of interest, and $k$ = a constant (e.g. the money Joseph buried).  In this case, $P = 1,000$ , $r = .03$ , and $k = 1,000$  The equation is as follows:  $A = P(1 + nr) + k$  Plugging in the above value:  $A = 1000(1 + .03n) + 1,000$  <b>Question 2</b>  In the scenario above:  1. Why is $k$ a constant? 2. What is the original simple interest rate function called when a constant

Arizona's College and Career Ready Standards – Mathematics for **BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Functions: Linear, Quadratic, and Exponential Models ★ (F-LE)</b> <b>Interpret expressions for functions in terms of the situation they model.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
					<p>k is to be added to it?</p> <ol style="list-style-type: none"> <li>What is the implication of adding the constant k to the simple interest function?</li> <li>Why is the constant added to the base function?</li> </ol> <p><b>Solution:</b></p> <ol style="list-style-type: none"> <li>The \$1,000 buried in the backyard remains constant; it doesn't get interest added to it.</li> <li>The original interest function, <math>A = P(1 + nr)</math> is referred to as the base.</li> <li>By adding the constant to make <math>A = 1000(1 + nr) + k</math>, the function is shifted up on the y axis by \$1,000.</li> <li>To show that in this case, \$1,000 was not gathering interest (because it was buried in the ground) and the other \$1,000 was accruing simple interest at a rate of 3%</li> </ol>

<b>Functions: Trigonometric Functions ★ (F-TF)</b> <b>Extend the domain of trigonometric functions using the unit circle.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.F-TF.A.1.</b> Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	A II				

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<b>Functions: Trigonometric Functions ★ (F-TF)</b> <b>Extend the domain of trigonometric functions using the unit circle.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.F-TF.A.2.</b> Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.  Connections: <i>ETHS-S1C2-01; 11-12.WHST.2b; 11-12.WHST.2e</i>	A II	<i>HS.MP.2.</i> Reason abstractly and quantitatively.			
<b>HS.F-TF.A.3.</b> Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$ , $\pi/4$ and $\pi/6$ , and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$ , $\pi+x$ , and $2\pi-x$ in terms of their values for $x$ ,	+	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Functions: Trigonometric Functions ★ (F-TF)</b> <b>Extend the domain of trigonometric functions using the unit circle.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
where $x$ is any real number.  Connection: 11-12.WHST.2b					
<b>HS.F-TF.A.4.</b> Use the units circle to explain symmetry (odd and even) and periodicity of trigonometric functions.  Connections: <i>ETHS-S1C2-01</i> ; 11-12.WHST.2c	+	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.5.</i> Use appropriate tools strategically.			

<b>Functions: Trigonometric Functions ★ (F-TF)</b> <b>Model periodic phenomena with trigonometric functions.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
<b>HS.F-TF.B.5.</b> Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.	A II ★	<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.7.</i> Look for			



**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Functions: Trigonometric Functions ★ (F-TF)</b> <b>Model periodic phenomena with trigonometric functions.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
Connection: <i>ETHS-S1C2-01</i>		and make use of structure.			
<b>HS.F-TF.B.6.</b> Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.  Connections: <i>ETHS-S1C2-01; 11-12.WHST.2e</i>	+				
<b>HS.F-TF.B.7.</b> Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.  Connections: <i>ETHS-S1C2-01; 11-12.WHST.1a</i>	+ ★	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.5.</i> Use appropriate tools strategically.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Functions: Trigonometric Functions ★ (F-TF)</b> <b>Prove and apply trigonometric identities.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.F-TF.C.8.</b> Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$ , $\cos(\theta)$ , or $\tan(\theta)$ given $\sin(\theta)$ , $\cos(\theta)$ , or $\tan(\theta)$ and the quadrant of the angle.  Connection: 11-12.WHST.1a-1e	A II	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.			
<b>HS.F-TF.C.9.</b> Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.  Connection: 11-12.WHST.1a-1e	+	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Congruence (G-CO)</b> <b>Experiment with transformations in the plane.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.G-CO.A.1.</b> Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.  Connection: 9-10.RST.4	G	<i>HS.MP.6.</i> Attend to precision.			
<b>HS.G-CO.A.2.</b> Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g.,	G	<i>HS.MP.5.</i> Use appropriate tools strategically.			

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<b>Geometry: Congruence (G-CO)</b>					
<b>Experiment with transformations in the plane.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
translation versus horizontal stretch).  Connection: <i>ETHS-S6C1-03</i>					
<b>HS.G-CO.A.3.</b> Given a rectangle, parallelogram, trapezoid, or regular polygons, describe the rotations and reflections that carry it onto itself.  Connections: <i>ETHS-S6C1-03; 9-10.WHST.2c</i>	G	<i>HS.MP.3</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.5.</i> Use appropriate tools strategically.			
<b>HS.G-CO.A.4.</b> Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.  Connections: <i>ETHS-S6C1-03; 9-10.WHST.4</i>	G	<i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.G-CO.A.5.</b> Given a geometric figure	G	<i>HS.MP.3.</i> Construct viable			

Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

<b>Geometry: Congruence (G-CO)</b> <b>Experiment with transformations in the plane.</b>					
<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>
and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.  Connections: <i>ETHS-S6C1-03; 9-10.WHST.3</i>		arguments and critique the reasoning of others.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.7.</i> Look for and make use of structure.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Congruence (G-CO)</b> <b>Understand congruence in terms of rigid motions.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
<b>HS.G-CO.B.6.</b> Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.  Connections: <i>ETHS-S1C2-01; 9-10.WHST.1e</i>	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.G-CO.B.7.</b> Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Congruence (G-CO)</b>					
<b>Understand congruence in terms of rigid motions.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
Connection: 9-10.WHST.1e					
<b>HS.G-CO.B.8.</b> Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.  Connection: 9-10.WHST.1e	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.			

<b>Geometry: Congruence (G-CO)</b>					
<b>Prove geometric theorems.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
<b>HS.G-CO.C.9.</b> Prove theorems about lines and angles. <i>Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are</i>	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.5.</i> Use appropriate tools strategically.			

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<b>Geometry: Congruence (G-CO)</b> <b>Prove geometric theorems.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<i>congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.</i>  Connections: <i>ETHS-S1C2-01; 9-10.WHST.1a-1e</i>					
<b>HS.G-CO.C.10.</b> Prove theorems about triangles. <i>Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.</i>  Connections: <i>ETHS-</i>	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.5.</i> Use appropriate tools strategically.			



Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

<b>Geometry: Congruence (G-CO)</b> <b>Prove geometric theorems.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<i>S1C2-01; 9-10.WHST.1a-1e</i>					
<b>HS.G-CO.C.11.</b> Prove theorems about parallelograms. <i>Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.</i>  Connection: 9-10.WHST.1a-1e	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.5.</i> Use appropriate tools strategically.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Congruence (G-CO)</b> <b>Make geometric constructions.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.G-CO.D.12.</b> Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). <i>Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.</i>  Connection: <i>ETHS-S6C1-03</i>	G	<i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.			
<b>HS.G-CO.D.13.</b> Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	G	<i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.			

Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

<b>Geometry: Congruence (G-CO)</b> <b>Make geometric constructions.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
Connection: <i>ETHS-S6C1-03</i>					

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT)</b>					
<b>Understand similarity in terms of similarity transformations.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.G-SRT.A.1.</b> Verify experimentally the properties of dilations given by a center and a scale factor:  Connections: <i>ETHS-S1C2-01; 9-10.WHST.1b; 9-10.WHST.1e</i>	G	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.5.</i> Use appropriate tools strategically.			
a. Dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.	G				
b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	G				
<b>HS.G-SRT.A.2.</b> Given two figures, use the definition of similarity in terms of	G	<i>HS.MP.3.</i> Construct viable arguments and critique the			

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<b>Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT)</b> <b>Understand similarity in terms of similarity transformations.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.  Connections: <i>ETHS-S1C2-01; 9-10.RST.4; 9-10.WHST.1c</i>		reasoning of others.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.G-SRT.A.3.</b> Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.  Connections: <i>ETHS-S1C2-01; 9-10.RST.7</i>	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT)</b>					
<b>Prove theorems involving similarity.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.G-SRT.B.4.</b> Prove theorems about triangles. <i>Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.</i>  Connections: <i>ETHS-S1C2-01; 9-10.WHST.1a-1e</i>	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.5.</i> Use appropriate tools strategically.			
<b>HS.G-SRT.B.5.</b> Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.  Connections: <i>ETHS-S1C2-01; 9-10.WHST.1a-1e</i>	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.5.</i> Use appropriate tools strategically.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT)</b> <b>Define trigonometric ratios and solve problems involving right triangles.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.G-SRT.C.6.</b> Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.  Connection: <i>ETHS-S6C1-03</i>	G				
<b>HS.G-SRT.C.7.</b> Explain and use the relationship between the sine and cosine of complementary angles.  Connections: <i>ETHS-S1C2-01; ETHS-S6C1-03; 9-10.WHST.1c; 9-10.WHST.1e</i>	G				
<b>HS.G-SRT.C.8.</b> Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	G ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.4.</i> Model with			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT)</b> <b>Define trigonometric ratios and solve problems involving right triangles.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
Connections: <i>ETHS-S6C2-03</i> ; <i>9-10.RST.7</i>		mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.			

<b>Geometry: Circles (G-SRT)</b> <b>Apply trigonometry to general triangles.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.G-SRT.D.9.</b> Derive the formula $A = \frac{1}{2} ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.  Connection: <i>ETHS-S6C1-03</i>	+	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.G-SRT.D.10.</b> Prove the Laws of Sines and Cosines and use them to solve problems.  Connections: <i>ETHS-S6C1-03</i> ;	+	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with			



**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Circles (G-SRT)</b> <b>Apply trigonometry to general triangles.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
11-12.WHST.1a-1e		mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			
<b>HS.G-SRT.D.11.</b> Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).  Connections: 11-12.WHST.2c; 11-12.WHST.2e	+	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.4.</i> Model with mathematics.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Circles (G-SRT)</b> <b>Apply trigonometry to general triangles.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.G-SRT.D.11.</b> Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).  Connections: 11-12.WHST.2c; 11-12.WHST.2e	+	HS.MP.1. Make sense of problems and persevere in solving them.  HS.MP.4. Model with mathematics.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Circles (G-C)</b>					
<b>Understand and apply theorems about circles.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.G-C.A.1.</b> Prove that all circles are similar.  Connections: <i>ETHS-S1C2-01; 9-10.WHST.1a-1e</i>	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.5.</i> Use appropriate tools strategically.			
<b>HS.G-C.A.2.</b> Identify and describe relationships among inscribed angles, radii, and chords. <i>Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.</i>  Connections: <i>9-10.WHST.1c;</i>	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.5.</i> Use appropriate tools strategically.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Circles (G-C)</b>					
<b>Understand and apply theorems about circles.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<i>11-12.WHST.1c</i>					
<b>HS.G-C.A.3.</b> Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.5.</i> Use appropriate tools strategically.			
<b>HS.G-C.A.4.</b> Construct a tangent line from a point outside a given circle to the circle.  Connection: <i>ETHS-S6C1-03</i>	+	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.5.</i> Use appropriate tools strategically.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Circles (G-C)</b> <b>Find arc lengths and areas of sectors of circles.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS-G-C.B.5.</b> Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.  Connections: <i>ETHS-S1C2-01; 11-12.RST.4</i>	G	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Expressing Geometric Properties with Equations (G-GPE)</b> <b>Translate between the geometric description and the equation for a conic section.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.G-GPE.A.1.</b> Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.  Connections: <i>ETHS-S1C2-01; 11-12.RST.4</i>	G	<i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			
<b>HS.G-GPE.A.2.</b> Derive the equation of a parabola given a focus and directrix.  Connections: <i>ETHS-S1C2-01; 11-12.RST.4</i>	A II	<i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			
<b>HS.G-GPE.A.3.</b> Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of	+	<i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Expressing Geometric Properties with Equations (G-GPE)</b> <b>Translate between the geometric description and the equation for a conic section.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
distances from the foci is constant.  Connections: <i>ETHS-S1C2-01; 11-12.RST.4</i>		reasoning.			

<b>Geometry: Expressing Geometric Properties with Equations (G-GPE)</b> <b>Use coordinates to prove simple geometric theorems algebraically.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.G-GPE.B.4.</b> Use coordinates to prove simple geometric theorems algebraically. <i>For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, <math>\sqrt{3}</math>) lies on the circle centered at the origin and containing the point (0, 2).</i>  Connections: <i>ETHS-</i>	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Expressing Geometric Properties with Equations (G-GPE)</b> <b>Use coordinates to prove simple geometric theorems algebraically.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<i>S1C2-01; 9-10.WHST.1a-1e; 11-12.WHST.1a-1e</i>					
<b>HS.G-GPE.B.5.</b> Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).  Connection: 9-10.WHST.1a-1e	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			
<b>HS.G-GPE.B.6.</b> Find the point on a directed line segment between two given points that partitions the segment in a given ratio.  Connections: <i>ETHS-S1C2-01; 9-10.RST.3</i>	G	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			



**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Expressing Geometric Properties with Equations (G-GPE)</b> <b>Use coordinates to prove simple geometric theorems algebraically.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.G-GPE.B.7.</b> Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.  Connections: <i>ETHS-S1C2-01; 9-10.RST.3; 11-12.RST.3</i>	G ★	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Geometric Measurement and Dimension (G-GMD)</b> <b>Explain volume formulas and use them to solve problems.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
<b>HS.G-GMD.A.1.</b> Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. <i>Use dissection arguments, Cavalieri's principle, and informal limit arguments.</i>  Connections: 9-10.RST.4; 9-10.WHST.1c; 9-10.WHST.1e; 11-12.RST.4; 11-12.WHST.1c; 11-12.WHST.1e	G	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.			
<b>HS.G-GMD.A.2.</b> Give an informal argument using Cavalieri's principle for the volume of a sphere and other solid figures.  Connections: 9-10.RST.4;	+	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Geometric Measurement and Dimension (G-GMD)</b> <b>Explain volume formulas and use them to solve problems.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
9-10.WHST.1c; 9-10.WHST.1e; 11-12.RST.4; 11-12.WHST.1c; 11-12.WHST.1e		HS.MP.5. Use appropriate tools strategically.			
<b>HS.G-GMD.A.3.</b> Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.  Connection: 9-10.RST.4	G ★	HS.MP.1. Make sense of problems and persevere in solving them.  HS.MP.2. Reason abstractly and quantitatively.			

<b>Geometry: Geometric Measurement and Dimension (G-GMD)</b> <b>Visualize relationships between two-dimensional and three dimensional objects.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.G-GMD.B.4.</b> Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	G	HS.MP.4. Model with mathematics.  HS.MP.5. Use appropriate tools strategically.			

Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

<b>Geometry: Geometric Measurement and Dimension (G-GMD)</b> <b>Visualize relationships between two-dimensional and three dimensional objects.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
Connection: <i>ETHS-S1C2-01</i>					

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Geometry: Geometric Measurement and Dimension ★ (G-MG)</b> <b>Apply geometric concepts in modeling situations.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
<b>HS.G-MG.A.1.</b> Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).  Connections: <i>ETHS-S1C2-01; 9-10.WHST.2c</i>	G ★	<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.G-MG.A.2.</b> Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).  Connection: <i>ETHS-S1C2-01</i>	G ★	<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.G-MG.A.3.</b> Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or	G ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.4.</i> Model with mathematics.			

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<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
minimize cost; working with typographic grid systems based on ratios).  Connection: <i>ETHS-S1C2-01</i>		<i>HS.MP.5.</i> Use appropriate tools strategically.			

## Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

<b><u>Statistics and Probability: Interpreting Categorical and Quantitative Data★ (S-ID)</u></b>					
<b>Summarize, represent, and interpret data on a single count or measurement variable.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.S-ID.A.1.</b> Represent data with plots on the real number line (dot plots, histograms, and box plots).  Connections: SCCHS-S1C1-04; SCCHS-S1C2-03; SCCHS-S1C2-05; SCCHS-S1C4-02; SCCHS-S2C1-04; ETHS-S6C2-03; SSHS-S1C1-04; 9-10.RST.7	A I ★	<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.	1.2	To comprehend how companies compete for market share using price	<p><b>Question 1</b></p> <p>As a semester-long fundraiser, DECA and FBLA decided to sell candy. The two clubs took different approaches, with DECA selling the candy for a flat rate, while FBLA tried different prices in order to maximize profits in the shortest time. They each bought 1000 candy bars at 25 cents each.</p> <p>DECA sold the candy bars for 75 cents each and sold 100 each day. FBLA sold the candy for \$1.00 each on the first day and sold 40 bars. The second day, they priced the bars at 90 cents each and sold 80 bars. The third day, they sold 90 bars at 80 cents each. The fourth day, they sold 160 bars at 70 cents each. The fifth day, they sold 300 bars at 60 cents each. The sixth day, they sold all the rest of their inventory at 50 cents per bar.</p> <ul style="list-style-type: none"> <li>1. How much total profit did DECA make at the end of six days?</li> <li>2. How much profit did DECA make per day?</li> </ul> <p><b>Solution:</b></p> <ul style="list-style-type: none"> <li>1. \$300</li> <li>2. \$50</li> </ul> <p><b>Question 2</b></p> <p>In the scenario above:</p> <ul style="list-style-type: none"> <li>3. How much total profit did FBLA make at the end of six days?</li> <li>4. How much average profit did FBLA make each day?</li> <li>5. Which group was more successful? Explain.</li> <li>6. At what price should FBLA sell their candy to maximize profits over a given time period?</li> </ul>
			1.5	To utilize financial data to make decisions and formulate plans	
			8.2	To evaluate financial data to determine if financial goals were met	
			10.2	To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	

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**Statistics and Probability: Interpreting Categorical and Quantitative Data★ (S-ID)**

Summarize, represent, and interpret data on a single count or measurement variable.

<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>																																													
					<p>Create a chart to answer questions 3, 4, 5, and 6.</p> <p><b>Solution:</b></p> <table><tr><th>DAY</th><th>PRICE</th><th>NUMBER SOLD</th><th>PROFIT PER DAY</th><th>TOTAL PROFIT</th></tr><tr><td>1</td><td>\$1.00</td><td>40</td><td>\$75</td><td>\$30.00</td></tr><tr><td>2</td><td>.90</td><td>80</td><td>65</td><td>52.00</td></tr><tr><td>3</td><td>.80</td><td>90</td><td>55</td><td>49.50</td></tr><tr><td>4</td><td>.70</td><td>160</td><td>45</td><td>72.00</td></tr><tr><td>5</td><td>.60</td><td>300</td><td>35</td><td>105.00</td></tr><tr><td>6</td><td>.50</td><td>330</td><td>25</td><td>82.50</td></tr><tr><td>Average</td><td>.75</td><td>1000</td><td>50</td><td>65.17</td></tr><tr><td colspan="4">TOTAL</td><td>\$391.00</td></tr></table> <p>3. \$391 4. Divide total profit by number of days: <math>\\$391/6 = \\$65.16</math> 5. DECA made \$300 in 6 days or \$50 per day. FBLA made \$391. in 6 days or \$65 per day. FBLA was more successful. 6. 60 cents</p> <p><b>Question 3</b></p>	DAY	PRICE	NUMBER SOLD	PROFIT PER DAY	TOTAL PROFIT	1	\$1.00	40	\$75	\$30.00	2	.90	80	65	52.00	3	.80	90	55	49.50	4	.70	160	45	72.00	5	.60	300	35	105.00	6	.50	330	25	82.50	Average	.75	1000	50	65.17	TOTAL				\$391.00
DAY	PRICE	NUMBER SOLD	PROFIT PER DAY	TOTAL PROFIT																																														
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Statistics and Probability: Interpreting Categorical and Quantitative Data★ (S-ID)																			
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<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>														
					<p>If FBLA sold candy at their optimum price, how much would they make in 10 days? Represent the data with a graph.</p> <p><b>Solution:</b></p> <div><p><b>TOTAL PROFIT</b></p><table><thead><tr><th>Price</th><th>Profit</th></tr></thead><tbody><tr><td>\$1.00</td><td>\$25.00</td></tr><tr><td>\$0.90</td><td>\$50.00</td></tr><tr><td>\$0.80</td><td>\$50.00</td></tr><tr><td>\$0.70</td><td>\$75.00</td></tr><tr><td>\$0.60</td><td>\$100.00</td></tr><tr><td>\$0.50</td><td>\$80.00</td></tr></tbody></table></div> <p>FBLA would make \$1,050.00, more than twice what DECA would make.</p>	Price	Profit	\$1.00	\$25.00	\$0.90	\$50.00	\$0.80	\$50.00	\$0.70	\$75.00	\$0.60	\$100.00	\$0.50	\$80.00
Price	Profit																		
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\$0.60	\$100.00																		
\$0.50	\$80.00																		
<b>HS.S-ID.A.2.</b> Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or	A I★	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.	1.2  1.5  8.2  9.2	To analyze a company’s sales data over time to determine profitability	<p><b>Project</b></p> <p>Students may use spreadsheets, graphing calculators and statistical software for calculations, summaries, and comparisons of data sets.</p> <p>A company is comparing the weekly sales at two of its stores:</p> <p>Store A - \$25,000, \$23,000, \$11,000, \$31,000, \$15,000, \$9,000, \$25,000, \$14,000, \$18,000</p>														

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more different data sets.  Connections: <i>SCHS-S1C3-06; ETHS-S6C2-03; SSHS-S1C1-01</i>		<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.7.</i> Look for and make use of structure.			<p>Store B - \$21,000, \$29,000, \$13,000, \$10,000, \$18,000, \$19,000, \$21,000, \$17,000, \$11,000</p> <p>Find the mean, median, mode, interquartile range, and standard deviation for each store.</p> <p><b>Solution:</b></p> <p>To begin statistical analysis the weekly sales, covering 9 weeks of both stores, are ranked in order from lowest weekly sales to highest, as follows:</p> <p>Store A – 9000, 11000, 14000, 15000, 18000, 23000, 25000, 25000, 31000</p> <p>Store B – 10000, 11000, 13000, 17000, 18000, 19000, 21000, 21000, 29000</p> <p>Statistics is largely used to analyze data by comparing its center (known as the measure of central tendency) and its spread.</p> <p>The <b>mean</b> is found by taking the average of the sales for each store. The formula for determining the mean is:</p> <p><math>M = \sum x / n</math> where M = mean, <math>\sum x</math> = sum of total sales, and n = number of weekly sales</p> <p>For Store A:</p> <p><math>\sum x = 9000 + 11000 + 14000 + 15000 + 18000 + 23000 + 25000 + 25000 + 31000 = 171000</math></p> <p>n = 9 (nine weeks of sales)</p> <p>Plugging these values into the formula:</p>

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<b>Statistics and Probability: Interpreting Categorical and Quantitative Data★ (S-ID)</b> <b>Summarize, represent, and interpret data on a single count or measurement variable.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
					<p> <math>M = 171000/9</math>   Mean = 19000   For Store B:   <math>\sum x = 10000 + 11000 + 13000 + 17000 + 18000 + 19000 + 21000 + 21000 + 29000 = 159,000</math>   <math>n = 9</math> (nine weeks of sales)   Plugging these values into the formula:   <math>M = 159000/9</math>   Mean = 17,667   Store A's mean (\$19,000) is higher than Store B's mean (\$17,667). </p> <hr/> <p> <b>Median</b> represents the middle statistic in a string of statistics. Again, sales are ranked from lowest to highest. Because there are 9 sales for each, the mean will be the 5<sup>th</sup> statistic in order for each store (4 statistics are above and 4 are below, with the 5<sup>th</sup> statistic in the middle.   For Store A:   9000, 11000, 14000, 15000, 18000, 23000, 25000, 25000, 31000   For Store B:   10000, 11000, 13000, 17000, 18000, 19000, 21000, 21000, 29000 </p>

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<b>Statistics and Probability: Interpreting Categorical and Quantitative Data★ (S-ID)</b> <b>Summarize, represent, and interpret data on a single count or measurement variable.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
					<p>For both stores, the median is the same: 18000.</p> <hr/> <p><b>Mode</b> denotes the most frequently found statistical value found in each string of statistical data. If no value repeats, there is no mode. There can be more than one set of repeaters (e.g. 4, 4, 5, 5, 5, 6), in which case the data that repeats the most (in this case 5) will be the mode. If more than one set of numbers repeat, but to the same degree (e.g. 4, 4, 5, 5, 6), then there would be as many modes as there are repeaters of the same degree (in this case, 4 and 5).</p> <p>Store A:</p> <p>The statistical value 25,000 is repeated twice, and there are no other repeaters. Therefore the mode for Store A is \$25,000.</p> <p>Store B:</p> <p>The statistical value 21,000 is repeated twice, and there are no other repeaters. Therefore the mode for Store B is \$21,000.</p> <p>Store A therefore has the higher mode, but the central tendency reflected by the mode in both stores is not strong since there are only two repeating statistics in each set of statistical values.</p> <hr/> <p><b>Interquartile range</b> describes the spread of each set of statistical values. To find the range, the lowest value is subtracted from the highest value and the result is the interquartile range.</p> <p>Store A interquartile range:</p> <p>25000-15000 = 10000</p>

Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

<b>Statistics and Probability: Interpreting Categorical and Quantitative Data★ (S-ID)</b> Summarize, represent, and interpret data on a single count or measurement variable.					
<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>
					<p>Store B interquartile range:</p> <p>21000-13000 = 8000</p> <hr/> <p>The <b>standard deviation</b> is a statistic that describes how tightly all the analytical data are clustered around the mean in a set of data. When the examples are bunched together, they form a steep bell-shaped curve on a chart, and this makes the standard deviation small. When the examples are spread apart and the bell curve is relatively flat, there is a relatively large standard deviation.</p> <p>To calculate standard deviation, find the mean of the data set and subtract the mean from each statistical value in the original data set, then square each result. Find their sum and divide that by the population size of the data set and take the square root of the entire result. The formula for this calculation is as follows:</p> $\sigma = \sqrt{\frac{\sum(x - \bar{x})^2}{N}}$ <p>where,</p> <p><math>\sigma</math> = the standard deviation</p> <p><math>x</math> = each value in the population</p> <p><math>\bar{x}</math> = the mean of the values</p> <p><math>N</math> = the number of values (the population)</p> <p>Store A standard deviation:</p>

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<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>
					<p>Start by ordering the statistical data for store A:</p> <p>9000, 11000, 14000, 15000, 18000, 23000, 25000, 25000, 31000</p> <p>Mean = 19,000 (previously found above)</p> <p>Subtract the mean from these statistical values:</p> <p>9000 – 19000 = -10,000; 11000 – 19000 = - 8000; 14,000 – 19000 = -5000; 15000 – 19000 = - 4000; 18000 – 19000 = - 1000; 23000 – 19000 = 4000; 25,000 – 19000 = 6000; 25000 – 19000 = 6000; 31000 – 19000 = 12000</p> <p>Therefore, the revised statistical values are: - 10,000, - 8000, - 5000, - 4000, - 1000, 4000, 6000, 6000, and 12000.</p> <p>Next, square each result and add them together: <math>(- 10,000^2) + (- 8000^2) + (- 5000^2) + (- 4000^2) + (- 1000^2) + (4,000^2) + (6000^2) + (6000^2) + (12,000^2) = 48666667</math></p> <p>Next, divide this result by N, which represents the population (total number of statistical values). N = 9</p> <p><math>48666667/9 = 5407407.444</math></p> <p>Then take the square root of that result and get:</p> <p><math>\sqrt{5407407.444} = 2325</math></p> <p>Standard deviation for Store A = 2325.</p> <hr/> <p>Store B standard deviation</p>

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<b>Statistics and Probability: Interpreting Categorical and Quantitative Data★ (S-ID)</b> <b>Summarize, represent, and interpret data on a single count or measurement variable.</b>					
<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
					<p>Start by ordering the statistical data for store B:</p> <p>10000, 11000, 13000, 17000 + 18000, 19000, 21000, 21000, 29000</p> <p>Mean = 17,667 (previously found above)</p> <p>Subtract the mean from these statistical values:</p> <p><math>10000 - 17667 = -7667</math>; <math>11000 - 17667 = -6667</math>; <math>13,000 - 17667 = -4667</math>; <math>17000 - 17667 = -667</math>; <math>18000 - 17667 = 333</math>; <math>19000 - 17667 = 1333</math>; <math>21,000 - 17667 = 3333</math>; <math>21000 - 17667 = 3333</math>; <math>29000 - 17667 = 11333</math></p> <p>Therefore, the revised statistical values are: -7667, -6667, -4667, -667, 333, 1333, 3333, 3333, and 11333.</p> <p>Next, square each result and add them together: <math>(-7667^2) + (-6667^2) + (-4667^2) + (-667^2) + (333^2) + (1333^2) + (3333^2) + (3333^2) + (11333^2) = 278000001</math></p> <p>Next, divide this result by N, which represents the population (total number of statistical values). <math>N = 9</math></p> <p><math>278000001/9 = 30888889</math></p> <p>Take the square root of that result and get:</p> <p><math>\sqrt{30888889} = 5558</math></p> <p>Standard deviation for Store B = 5558</p> <p>The standard deviation for Store A is 2325, and for Store B it is 5558. As stated previously the smaller standard deviation (in this case of Store A) is caused by a</p>

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Statistics and Probability: Interpreting Categorical and Quantitative Data★ (S-ID)</b> <b>Summarize, represent, and interpret data on a single count or measurement variable.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
					steeper bell shaped curve of data than for Store B.
<b>HS.S-ID.A.3.</b> Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).  Connections: <i>SSHS-S1C1-01; ETHS-S6C2-03; 9-10.WHST.1a</i>	A I ★	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.S-ID.A.4.</b> Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for	A II ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable			



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<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.  Connections: <i>ETHS-S1C2-01; ETHS-S6C2-03; 11-12.RST.7; 11-12.RST.8; 11-12.WRT.1b</i>		arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			

## Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)

## Statistics and Probability: Interpreting Categorical and Quantitative Data ★ (S-ID)

**Summarize, represent, and interpret data on two categorical and quantitative variables.**

<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>																											
<b>HS.S-ID.B.5.</b> Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.  Connections: <i>ETHS-S1C2-01; ETHS-S6C2-03; 11-12.RST.9; 11-12.WHST.1a-1b; 11-12.WHST.1e</i>	A I ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.	2.7          10.2	To differentiate business trends in markets      To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	Deborah's company conducts market research to determine which type of advertising is most effective.   Ages 12 and under: electronic ads 27,274, print ads 1,119 Ages 13-17: electronic ads 22,108, print ads 8,540 Ages 19-24: electronic ads 28,486, print ads 9,114 Ages 25-29: electronic ads 31,609, print ads 5,031 Ages 30-39: electronic ads 26,402, print ads 10,820 Ages 40-49: electronic ads 20,144, print ads 21,715 Ages 50-59: electronic ads 18,032, print ads 32,540 Ages 60 and over: electronic ads 12,767, print ads 42,982  1. Create a two-way frequency table to display the relationships between the age groups and their preferences.  <b>Solution:</b> <table><tr><th>Age Groups</th><th>Electronic Ads</th><th>Print Ads</th></tr><tr><td>12 and under</td><td>27,274</td><td>1,119</td></tr><tr><td>13-17</td><td>22,108</td><td>8,540</td></tr><tr><td>19-24</td><td>28,486</td><td>9,114</td></tr><tr><td>25-29</td><td>31,609</td><td>5,031</td></tr><tr><td>30-39</td><td>26,402</td><td>10,820</td></tr><tr><td>40-49</td><td>20,144</td><td>21,715</td></tr><tr><td>50-59</td><td>18,032</td><td>32,540</td></tr><tr><td>60 and over</td><td>12,767</td><td>42,982</td></tr></table>  2. Use the data above to create a relative frequency table.  <b>Solution:</b>	Age Groups	Electronic Ads	Print Ads	12 and under	27,274	1,119	13-17	22,108	8,540	19-24	28,486	9,114	25-29	31,609	5,031	30-39	26,402	10,820	40-49	20,144	21,715	50-59	18,032	32,540	60 and over	12,767	42,982
Age Groups	Electronic Ads	Print Ads																														
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Statistics and Probability: Interpreting Categorical and Quantitative Data ★ (S-ID)																																
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					<table><tr><th>Age Groups</th><th>Electronic Ads</th><th>Print Ads</th></tr><tr><td>12 and under</td><td>14.60%</td><td>.85%</td></tr><tr><td>13-17</td><td>11.83%</td><td>6.48%</td></tr><tr><td>19-24</td><td>15.25%</td><td>6.91%</td></tr><tr><td>25-29</td><td>16.92%</td><td>3.82%</td></tr><tr><td>30-39</td><td>14.13%</td><td>8.21%</td></tr><tr><td>40-49</td><td>10.78%</td><td>16.47%</td></tr><tr><td>50-59</td><td>9.65%</td><td>24.68%</td></tr><tr><td>60 and over</td><td>6.83%</td><td>32.60%</td></tr></table>	Age Groups	Electronic Ads	Print Ads	12 and under	14.60%	.85%	13-17	11.83%	6.48%	19-24	15.25%	6.91%	25-29	16.92%	3.82%	30-39	14.13%	8.21%	40-49	10.78%	16.47%	50-59	9.65%	24.68%	60 and over	6.83%	32.60%
Age Groups	Electronic Ads	Print Ads																														
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<b>HS.S-ID.B.6.</b> Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.  Connections: <i>SCHS-S1C2-05</i> ; <i>SCHS-S1C3-01</i> ; <i>ETHS-S1C2-01</i> ; <i>ETHS-S1C3-01</i> ; <i>ETHS-S6C2-03</i>	A I A II ★	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.																														
a. Fit a function to the data; use functions fitted to data to solve problems in the	A I A II ★	<i>HS.MP.7.</i> Look for and make use of																														

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<b>Statistics and Probability: Interpreting Categorical and Quantitative Data ★ (S-ID)</b> <b>Summarize, represent, and interpret data on two categorical and quantitative variables.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
context of the data. <i>Use given functions or chooses a function suggested by the context. Emphasize linear, quadratic, and exponential models.</i>  Connection: 11-12.RST.7		structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			
b. Informally assess the fit of a function by plotting and analyzing residuals.  Connections: 11-12.RST.7; 11-12.WHST.1b-1c	A I ★				
c. Fit a linear function for a scatter plot that suggests a linear association.  Connection: 11-12.RST.7	A I ★				

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<b>Statistics and Probability: Interpreting Categorical and Quantitative Data ★ (S-ID)</b>					
<b>Interpret linear models.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.S-ID.C.7.</b> Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.  Connections: <i>SCHS-S5C2-01; ETHS-S1C2-01; ETHS-S6C2-03; 9-10.RST.4; 9-10.RST.7; 9-10.WHST.2f</i>	A I ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.			
<b>HS.S-ID.C.8.</b> Compute (using technology) and interpret the correlation coefficient of a linear fit.  Connections: <i>ETHS-S1C2-01; ETHS-S6C2-03; 11-12.RST.5; 11-12.WHST.2e</i>	A I ★	<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

**Statistics and Probability: Interpreting Categorical and Quantitative Data ★ (S-ID)**

**Interpret linear models.**

<u><b>Standards</b></u> <i>Students are expected to:</i>	<u><b>TRAD</b></u>	<u><b>Mathematical Practices</b></u>	<u><b>CTE Standard / Measurement Criterion</b></u>	<u><b>Application of Mathematics Standard</b></u>	<u><b>Explanations and Examples</b></u>
<b>HS.S-ID.C.9.</b> Distinguish between correlation and causation.  Connection: 9-10.RST.9	AI ★	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.6.</i> Attend to precision.	1.5	To demonstrate the need for complete analysis using a number of comparative ratios	<p>On the weekend of December 25-27 of 2009, a movie titled <i>Law-Abiding Citizen</i> was the 31<sup>st</sup> highest grossing movie of the week. It had been out for 11 weeks. But on that weekend, <i>Law-Abiding Citizen</i> showed an increase in ticket sales of 58.3%. In fact, nine movies that had been in theaters for multiple weeks defied the odds and improved over the previous week.</p> <p>While it is logical to assume that the holiday weekend was the cause of the increases, that is not always the case. Three times in the past 10 years, total ticket sales were down on the holiday weekend compared to the previous weekend. Over the past 20 years, the average increase on that weekend was a modest 12.5%.</p> <p>But in 2009, it was 97.5%. It was the year of <i>Avatar</i>, the biggest money-making movie of all time.</p> <p>In what theater owners refer to as “spill-over effect,” people flocked to the theaters, found that <i>Avatar</i> was sold out, and just decided to see a different movie. <i>Blind Side</i> in its 6<sup>th</sup> week was up 14.9% and <i>Where the Wild Things Are</i>, in its 11<sup>th</sup> week, was up 251%.</p> <ol style="list-style-type: none"> <li>Does the increase in ticket sales on holiday weekends involve correlation or causation?</li> <li>Does the increase on the holiday weekend of 2009 because of the <i>Avatar</i> spill-over involve correlation or causation?</li> </ol> <p><b>Solution:</b></p> <p>Correlation. People tend to go to the movies more on holiday weekends, but the holiday does not make them go the movies.</p> <p>Causation. These people were already at the theater and wanted to see something, so they went to see something else.</p>

**Arizona's College and Career Ready Standards – Mathematics for BUSINESS MANAGEMENT & ADMINISTRATIVE SERVICES (BMAS)**

<b>Statistics and Probability: Making Inferences and Justifying Conclusions ★ (S-IC)</b> <b>Understand and evaluate random processes underlying statistical experiments.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.S-IC.A.1.</b> Understand statistics as a process for making inferences to be made about population parameters based on a random sample from that population.	A II ★	<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.6.</i> Attend to precision.			
<b>HS.S-IC.A.2.</b> Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. <i>For example, a model says a spinning coin will fall heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?</i>  Connections: <i>ETHS-S6C2-03; 9-10.WHST.2d; 9-10.WHST.2f</i>	A II ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools			

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<b>Statistics and Probability: Making Inferences and Justifying Conclusions ★ (S-IC)</b> <b>Understand and evaluate random processes underlying statistical experiments.</b>					
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		strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			

<b>Statistics and Probability: Making Inferences and Justifying Conclusions ★ (S-IC)</b> <b>Make inferences and justify conclusions from sample surveys, experiments, and observational studies.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.S-IC.B.3.</b> Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.  Connections: <i>11-</i>	A II ★	<i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.6.</i> Attend			



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<b>Statistics and Probability: Making Inferences and Justifying Conclusions ★ (S-IC)</b> <b>Make inferences and justify conclusions from sample surveys, experiments, and observational studies.</b>					
<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>
12.RST.9; 11-12.WHST.2b		to precision.			
<b>HS.S-IC.B.4.</b> Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.  Connections: <i>ETHS-S6C2-03; 11-12.RST.9; 11-12.WHST.1e</i>	A II ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.	2.7	To determine how research data can provide a basis for decision making.	The formula for margin of error is: $\sqrt{\frac{P(1-P)}{n}} \cdot 1.96$ where P is the percentage of the total number of people in the overall population who were actually surveyed.  If one has a population of 1000 and 50 people are surveyed, then P = .05, 1-P=.95, and n =1000.  What is the only way to get a margin of error equal to zero?  <b>Solution:</b> The only way would be to survey every person in the population. That way, the survey sample and population are the same. Then, the equation would be $\sqrt{\frac{1(1-1)}{1000}} = \sqrt{\frac{0}{1000}} = 0$ Unless everybody in the overall population is surveyed, there will always be a margin of error. The key is to get as small a margin of error as possible without spending time on too large a sample. It is a matter of what is acceptable to the survey taker(s).
<b>HS.S-IC.B.5.</b> Use data from a randomized	A II ★	<i>HS.MP.1.</i> Make sense of problems and persevere in			

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<b>Statistics and Probability: Making Inferences and Justifying Conclusions ★ (S-IC)</b> <b>Make inferences and justify conclusions from sample surveys, experiments, and observational studies.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
experiment to compare two treatments; use simulations to decide if differences between parameters are significant.  Connections: <i>ETHS-S6C2-03; 11-12.RST.4; 11-12.RST.5; 11-12.WHST.1e</i>		solving them.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			
<b>HS.S-IC.B.6.</b> Evaluate reports based on data.  Connections: <i>11-12.RST.4; 11-12.RST.5; 11-12.WHST.1b; 11-12.WHST.1e</i>	A II ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.			

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<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
		<i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			

<b>Statistics and Probability: Conditional Probability and the Rules of Probability ★ (S-CP)</b> <b>Understand independence and conditional probability and use them to interpret data.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.S-CP.A.1.</b> Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions,	A II ★	<i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.6.</i> Attend to precision.	2.6 2.7   10.2	To determine the best product for a specific market   To utilize appropriate software to generate graphs.	The manager of a mall is creating the advertising budget for the next quarter. He collects the following data:  On a Saturday afternoon between noon and 1:00 p.m., 222 people entered the Westside Mall. Before they left, 114 attended a movie, 87 ate at the food court, and 79 were approached by the salesperson at the cell phone kiosk. <ul style="list-style-type: none"> <li>• 72 ate at the food court and attended a movie</li> <li>• 69 saw a movie and were approached by the cell phone salesperson</li> </ul>

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<b>Statistics and Probability: Conditional Probability and the Rules of Probability ★ (S-CP)</b> <b>Understand independence and conditional probability and use them to interpret data.</b>					
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intersections, or complements of other events ("or," "and," "not").  Connection: 11-12.WHST.2e		HS.MP.7. Look for and make use of structure.			<ul style="list-style-type: none"> <li>64 ate at the food court and were approached by the cell phone salesperson</li> <li>40 ate at the food court, saw a movie, and were approached by the cell phone salesperson</li> </ul> <ol style="list-style-type: none"> <li>What product and/or service should receive the largest share of the advertising budget? Explain.</li> <li>How many people saw a movie but did not eat at the food court?</li> <li>Create a Venn diagram to display the data.</li> </ol> <p><b>Solution:</b></p> <ol style="list-style-type: none"> <li>Movie theater. More than half of the people who entered the mall (114 out of 222) went to the movies. A substantial number of the people who went to the movies also ate at the food court (72).</li> <li><math>114 (\text{movie}) - 72 (\text{movie and food}) = 42</math></li> <li></li> </ol>
<b>HS.S-CP.A.2.</b> Understand that two	A II ★	HS.MP.2. Reason abstractly and			

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<b>Statistics and Probability: Conditional Probability and the Rules of Probability ★ (S-CP)</b> <b>Understand independence and conditional probability and use them to interpret data.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<p>events <math>A</math> and <math>B</math> are independent if the probability of <math>A</math> and <math>B</math> occurring together is the product of their probabilities, and use this characterization to determine if they are independent.</p> <p>Connection: 11-12.WHST.1e</p>		<p>quantitatively.</p> <p><i>HS.MP.4.</i> Model with mathematics.</p> <p><i>HS.MP.6.</i> Attend to precision.</p> <p><i>HS.MP.7.</i> Look for and make use of structure.</p>			
<p><b>HS.S-CP.A.3.</b> Understand the conditional probability of <math>A</math> given <math>B</math> as <math>P(A \text{ and } B)/P(B)</math>, and interpret independence of <math>A</math> and <math>B</math> as saying that the conditional probability of <math>A</math> given <math>B</math> is the same as the probability of <math>A</math>, and the conditional probability of <math>B</math> given <math>A</math> is the same as the probability of <math>B</math>.</p>	<p>A II ★</p>	<p><i>HS.MP.2.</i> Reason abstractly and quantitatively.</p> <p><i>HS.MP.4.</i> Model with mathematics.</p> <p><i>HS.MP.6.</i> Attend to precision.</p> <p><i>HS.MP.7.</i> Look for and make use of structure.</p>			

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Connections: 11-12.RST.5; 11-12.WHST.1e																	
<b>HS.S-CP.A.4.</b> Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. <i>For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that</i>	A II ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for	2.6 2.7  10.2	To determine the best product for a specific market   To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	At a restaurant called Just Enchiladas, all dishes served (or take-out orders) include three enchiladas and nothing else. The owner keeps track of all sales for a week and notes the gender of the customer in each case.  The results are: <u>Men</u> Beef 240 orders Chicken 154 Cheese 128 Combination (of 2 or more types) 48  <u>Women</u> Beef 127 orders Chicken 148 Cheese 102 Combination (of 2 or more types) 0  1. Create a frequency table. 2. What is the probability that a man will order cheese enchiladas? 3. What is the probability that a woman will order chicken enchiladas? 4. Does the fact that no women ordered a combination plate during that week mean that no woman will ever order one?  <b>Solution:</b>  1. <table border="1"> <thead> <tr> <th></th><th>Beef</th><th>Chicken</th><th>Cheese</th><th>Combination</th><th>Total</th></tr> </thead> <tbody> <tr> <td><b>Men</b></td><td>240</td><td>154</td><td>128</td><td>48</td><td>570</td></tr> </tbody> </table>		Beef	Chicken	Cheese	Combination	Total	<b>Men</b>	240	154	128	48	570
	Beef	Chicken	Cheese	Combination	Total												
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<i>the student is in tenth grade. Do the same for other subjects and compare the results.</i>  Connections: <i>ETHS-S6C2-03; 11-12.RST.4; 11-12.RST.9; 11-12.WHST.1e</i>		and express regularity in repeated reasoning.			<table><tr><td>Women</td><td>127</td><td>148</td><td>102</td><td>0</td><td>377</td></tr><tr><td>Total</td><td>367</td><td>302</td><td>230</td><td>48</td><td>947</td></tr></table> <div>2. <math>\frac{128}{570} = .225</math> OR 22.5%</div> <div>3. <math>\frac{148}{377} = .3925</math> OR 39.3%</div> <div>4. No. The most one can conclude is that it is very unlikely, but without an infinite sample one can't be certain that it will never happen.</div>		Women	127	148	102	0	377	Total	367	302	230	48	947
Women	127	148	102	0	377													
Total	367	302	230	48	947													
<b>HS.S-CP.A.5.</b> Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. <i>For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.</i>  Connections: <i>11-12.RST.4;</i>	A II ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.	2.7        10.2	To determine product liability prior to sales      To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	A business delivered a box of 800 flash drives, of which Quality Control has determined 4 will be defective.  <div>1. What is the probability that the first flash drive chosen from the box will be defective?</div> <div>2. If the first 200 flash drives chosen are all in working order, what is the probability that the next one chosen will be defective?</div> <div>3. If 795 of the first 798 chosen work properly, what is the probability that the next one chosen is defective?</div> <b>Solution:</b> <div>1. <math>\frac{4}{800} = .005 = .5\%</math></div> <div>2. <math>\frac{4}{600} = .0067 = .67\%</math></div>													

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11-12.RST.5;11-12.WHST.1e					3. $\frac{1}{2} = .5 = 50\%$



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<b>Statistics and Probability: Conditional Probability and the Rules of Probability ★(S-CP)</b> <b>Use the rules of probability to compute probabilities of compound events in a uniform probability model.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.S-CP.B.6.</b> Find the conditional probability of $A$ given $B$ as the fraction of $B$ 's outcomes that also belong to $A$ , and interpret the answer in terms of the model.  Connections: <i>ETHS-S1C2-01; ETHS-S6C2-03; 11-12.RST.9; 11-12.WHST.1b; 11-12.WHST.1e</i>	A II ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.S-CP.B.7.</b> Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ , and interpret the answer in terms of the model.  Connections: <i>ETHS-S1C2-01; ETHS-S6C2-03; 11-12.RST.9</i>	A II ★	<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.S-CP.B.8.</b> Apply the general Multiplication Rule	+ ★	<i>HS.MP.4.</i> Model with			

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in a uniform probability model, $P(A \text{ and } B) = P(A)P(B A) = P(B)P(A B)$ , and interpret the answer in terms of the model.  Connections: <i>ETHS-S1C2-01; ETHS-S6C2-03; 11-12.RST.9</i>		mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.S-CP.B.9.</b> Use permutations and combinations to compute probabilities of compound events and solve problems.  Connections: <i>ETHS-S1C2-01; ETHS-S6C2-03; 11-12.RST.9</i>	+ ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.7.</i> Look for and make use of structure.			

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<b>Statistics and Probability: Using Probability to Make Decisions ★ (S-MD)</b> <b>Calculate expected values and use them to solve problems.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.S-MD.A.1.</b> Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.  Connections: <i>ETHS-S6C2-03; 11-12.RST.5; 11-12.RST.9; 11-12.WHST.1b; 11-12.WHST.1e</i>	+ ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			

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<b>Statistics and Probability: Using Probability to Make Decisions ★ (S-MD)</b> <b>Calculate expected values and use them to solve problems.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.S-MD.A.2.</b> Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.  Connections: <i>ETHS-S1C2-01; ETHS-S6C2-03; 11-12.RST.3; 11-12.RST.4; 11-12.RST.9</i>	+ ★	<i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.S-MD.A.3.</b> Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. <i>For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five</i>	+ ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.			

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<p>questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.</p> <p>Connections: ETHS-S1C2-01; ETHS-S6C2-03; 11-12.RST.3; 11-12.RST.9; 11-12.WHST.1b; 11-12.WHST.1e</p>		<p>HS.MP.7. Look for and make use of structure.</p>			
<p><b>HS.S-MD.A.4.</b> Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. <i>For example, find a current data distribution on the number of TV sets per household in the United States, and</i></p>	<p>+ ★</p>	<p>HS.MP.1. Make sense of problems and persevere in solving them.</p> <p>HS.MP.3. Construct viable arguments and critique the reasoning of others.</p> <p>HS.MP.4. Model with mathematics.</p> <p>HS.MP.5. Use appropriate tools</p>			

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<b>Statistics and Probability: Using Probability to Make Decisions ★ (S-MD)</b> <b>Calculate expected values and use them to solve problems.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?  Connections: <i>ETHS-S1C2-01; ETHS-S6C2-03; 11-12.RST.9; 11-12.WHST.1b; 11-12.WHST.1e</i>		strategically.  <i>HS.MP.7.</i> Look for and make use of structure.			

<b>Statistics and Probability: Using Probability to Make Decisions ★ (S-MD)</b> <b>Use probability to evaluate outcomes of decisions.</b>					
<b><u>Standards</u></b> <i>Students are expected to:</i>	<b><u>TRAD</u></b>	<b><u>Mathematical Practices</u></b>	<b><u>CTE Standard / Measurement Criterion</u></b>	<b><u>Application of Mathematics Standard</u></b>	<b><u>Explanations and Examples</u></b>
<b>HS.S-MD.B.5.</b> Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.  Connections: <i>SSHS-</i>	+ ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i>	1.5  1.6  9.3  10.2	To understand the probabilities associated with decisions (risk vs. reward)  To utilize appropriate software (word	<b>Question 1</b>  In the game of craps, a person rolls the dice. 1. If the player throws a 2, 3 or 12 on the first roll, she loses automatically. What is the probability that the player will lose on her first throw? 2. If the player rolls a 7 or an 11 on the first roll, she wins automatically. What is the probability she will win on the first throw?  <b>Solution:</b>

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<i>S5C2-03; SSHS-S5C5-03; SSHS-S5C5-05; ETHS-S1C2-01; ETHS-S6C2-03</i>		Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.		processing, spreadsheet, database, graphics, etc.)	<p>1. There is a <math>\frac{1}{9}</math> probability that the player will lose on the first roll. There is a <math>\frac{1}{36}</math> probability that she will throw a 2, a <math>\frac{2}{36}</math> probability of throwing a 3, and a <math>\frac{1}{36}</math> probability of throwing a 12.</p> $\frac{1}{36} + \frac{2}{36} + \frac{1}{36} = \frac{4}{36} = \frac{1}{9}$ <p>The player has a <math>\frac{2}{9}</math> probability of winning on her first throw.</p> $\frac{6}{36} + \frac{2}{36} = \frac{8}{36} = \frac{2}{9}$ <p><b>Question 2</b></p> <p>Matt is the owner of a business located in South Texas. His insurance agent will insure him against tornados, hurricanes, and monsoon damage at a cost of \$80,000 per year.</p> <p>He does the research and learns that in his area the probability of getting hit by a tornado is <math>\frac{1}{100}</math>. The probability of getting hit by a hurricane is <math>\frac{1}{50}</math>. The probability of monsoon damage is <math>\frac{1}{25}</math>.</p> <p>What is the probability of getting hit by any of those in a given year?</p>

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					<b>Solution:</b>  The probability of any of those happening is the sum of the probabilities. $\frac{1}{100} + \frac{1}{50} + \frac{1}{25} =$  Find the common denominator. $\frac{1}{100} + \frac{2}{100} + \frac{4}{100} = \frac{7}{100}$
a. Find the expected payoff for a game of chance. <i>For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.</i>  Connections: 11-12.RST.3; 11-12.RST.9; 11-12.WHST.1b; 11-12.WHST.1e	+ ★				
b. Evaluate and compare strategies on the basis of expected	+ ★				



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<p>values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.</p> <p>Connections: 11-12.RST.3; 11-12.RST.9; 11-12.WHST.1b; 11-12.WHST.1e</p>					
<p><b>HS.S-MD.B.6.</b> Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).</p> <p>Connections: <i>ETHS-S1C2-01</i>; <i>ETHS-S6C2-03</i>; 11-12.RST.3; 11-12.RST.9; 11-12.WHST.1b; 11-12.WHST.1e</p>	<p>+ ★</p>	<p><i>HS.MP.1.</i> Make sense of problems and persevere in solving them.</p> <p><i>HS.MP.2.</i> Reason abstractly and quantitatively.</p> <p><i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of</p>			

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		others. <i>HS.MP.4.</i> Model with mathematics. <i>HS.MP.5.</i> Use appropriate tools strategically. <i>HS.MP.7.</i> Look for and make use of structure.			
<b>HS.S-MD.B.7.</b> Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).  Connections: <i>ETHS-S1C2-01</i> ; <i>ETHS-S6C2-03</i>	+ ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them. <i>HS.MP.2.</i> Reason abstractly and quantitatively. <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others. <i>HS.MP.4.</i> Model with mathematics. <i>HS.MP.5.</i> Use appropriate tools strategically. <i>HS.MP.7.</i> Look for	2.7  7.7  10.2	To determine the profitability of a product and effects on product reputation  To utilize appropriate software (word processing, spreadsheet, database, graphics, etc.)	Quality Control has determined that 4 of every 800 flash drives a company purchases are defective.  1. Should the company recall the flash drives and remove them from the stores? Explain 2. What is the probability that any one drive is good? 3. If one were to remove the flash drives from the shipment, piece by piece, and stack them up, how many would one have to remove to have a 100% probability that at least one flash drive in the stack is defective? 4. What is the probability that the first 50 one takes out of the box are all good?  <b>Solution:</b>  1. No. It is not cost effective to recall the drives when only 5% are defective. It is more expensive to remove the drives from the retail stores, re-test them, and ship out the non-defective ones again. It is more cost-effective to replace the defective flash drives when the customers return them to the store. 2. $796/800 = .995 = 99.5\%$ 3. 797

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		and make use of structure.			<p>4. <math>(.995)^{50} = .778 = 77.8\%</math></p> <p>The probability that any one flash drive is good is .995.  Then the probability that two flash drives are good is:  <math>.995 \times .995 = .990025 = 99.0025\%</math></p>

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<b>Contemporary Mathematics: Discrete Mathematics ★ (CM-DM)</b> <b>Understand and apply vertex-edge graph topics.</b>					
<u>Standards</u> <i>Students are expected to:</i>	<u>TRAD</u>	<u>Mathematical Practices</u>	<u>CTE Standard / Measurement Criterion</u>	<u>Application of Mathematics Standard</u>	<u>Explanations and Examples</u>
<b>AZ.HS.CM-DM.A.1.</b> Study the following topics related to vertex-edge graphs: Euler circuits, Hamilton circuits, the Travelling Salesperson Problem (TSP), minimum weight spanning trees, shortest paths, vertex coloring, and adjacency matrices.  Connections: <i>ETHS-S6C2-03; 11-12.RST.4; 11-12.RST.5; 11-12.RST.9; 11-12.WHST.1b; 11-12.WHST.1e</i>	+ ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated reasoning.			

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<b>AZ.HS.CM-DM.A.2.</b> Understand, analyze, and apply vertex-edge graphs to model and solve problems related to paths, circuits, networks, and relationships among a finite number of elements, in real-world and abstract settings.  Connections: <i>ETHS-S6C2-03; 11-12.RST.9; 11-12.WHST.1b; 11-12.WHST.1e;</i>	+ ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in repeated			

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		reasoning.			
<b>AZ.HS.CM-DM.A.3.</b> Devise, analyze, and apply algorithms for solving vertex-edge graph problems.  Connections: <i>ETHS-S6C2-03; 11-12.RST.3; 11-12.RST.4; 11-12.RST.9; 11-12.WHST.1a; 11-12.WHST.1b; 11-12.WHST.1e</i>	+ ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express regularity in			

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		repeated reasoning			
<b>AZ.HS.CM-DM.A.4.</b> Extend work with adjacency matrices for graphs, such as interpreting row sums and using the $n$ th power of the adjacency matrix to count paths of length $n$ in a graph.  Connections: <i>ETHS-S6C2-03; 11-12.RST.4; 11-12.RST.5; 11-12.RST.9; 11-12.WHST.1a; 11-12.WHST.1b; 11-12.WHST.1e</i>	+ ★	<i>HS.MP.1.</i> Make sense of problems and persevere in solving them.  <i>HS.MP.2.</i> Reason abstractly and quantitatively.  <i>HS.MP.3.</i> Construct viable arguments and critique the reasoning of others.  <i>HS.MP.4.</i> Model with mathematics.  <i>HS.MP.5.</i> Use appropriate tools strategically.  <i>HS.MP.6.</i> Attend to precision.  <i>HS.MP.7.</i> Look for and make use of structure.  <i>HS.MP.8.</i> Look for and express			

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		regularity in repeated reasoning.			